Jacob's Ladder Trail Scenic Byway

Becket • Chester • Huntington • Lee • Russell

Improvements Plan: Phase II

JUNE 1995

PIONEER VALLEY PLANNING COMMISSION

JACOB'S LADDER TRAIL SCENIC BYWAY IMPROVEMENTS PLAN: PHASE II

Prepared by the
Pioneer Valley Planning Commission

in association with
Margo Jones, Architects
Vanasse Hangen Brustlin, Inc.
Holden Engineering and Surveying, Inc.

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Table Of Contents

Jacob's Ladder Trail Scenic Byway Improvements Plan: Phase II

• Russell • Huntington • Chester • Becket • Lee • Massachusetts

Background

The FY92 Phase I Jacob's Ladder Trail Scenic Byway Program was initiated by the Pioneer Valley Planning Commission (PVPC), with technical assistance from the Berkshire County Regional Planning Commission (BCRPC), in February 1993 and consisted of four major components: historic preservation, transportation, land use and economic development/tourism. The historic preservation activities focused on completing historic resource inventories for submission of sites and districts to the National Register of Historic Places. In addition, a landscape assessment was conducted along the corridor to assess the scenic and aesthetic qualities of the highway. The transportation assessment included an analysis of highway and safety conditions along Route 20 for both bicycle and motorist use. The land use assessment included a detailed review of the five communities zoning bylaws with suggested revisions to address potential development concerns along the highway. A tour book was published which promoted bicyclist and motorist use of the Jacob's Ladder Trail and its immediate area. In addition, much of the data which was collected was put into a series of GIS overlays and mylar base maps to be used in the ongoing assessment and management of the byway.

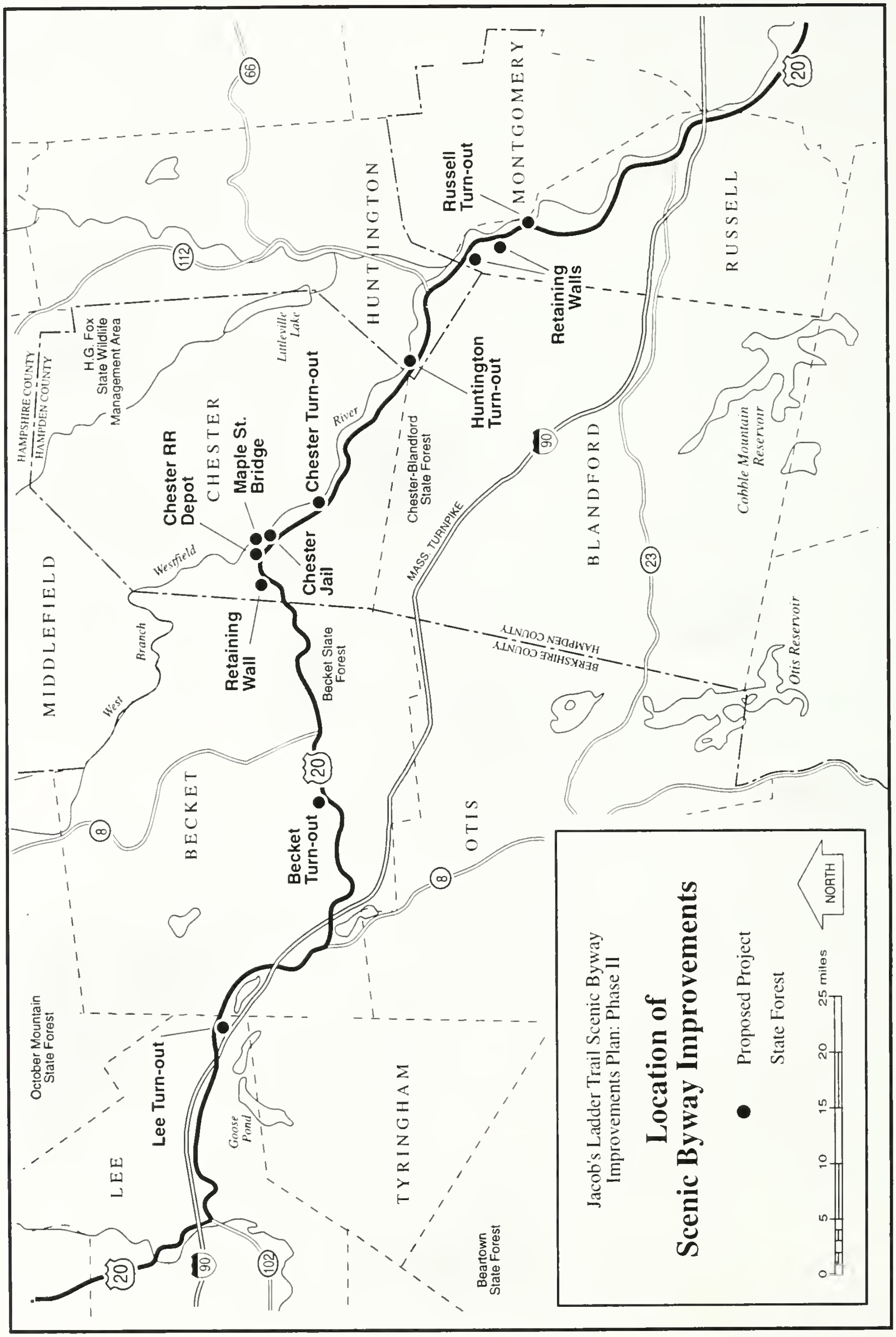
The Jacob's Ladder Trail Phase II Implementation Program began in March 1994. The intent of Phase II is to continue to meet the goals of the Interim Scenic Byways Program for Jacob's Ladder Trail by expanding upon the program established in Phase I through:

- attainment of local commitment
- accommodation of increased tourism and development of scenic byway amenities
- preservation/conservation of historic and cultural resources adjacent to the highway.

Phase II builds upon the planning work of Phase I, which initiated a scenic byway management program through components of historic preservation, land use, highway safety assessment, landscape assessment, map production and scenic bike tours.

Specifically, Phase II results in the preparation of designs for highway amenities which will enhance the scenic driving experience of motorists along the byway through a cohesive series of planned landscapes. Conceptual designs, design plans, outline specifications and cost estimates have been prepared for highway safety features, landscape improvements and highway amenities. This includes such items as improvements to existing roadside turn-outs, retaining wall repairs, guardrails, development of visitor and information centers, development of tourist destinations and related eligible projects. The locations of these areas are shown in Figure 1.

In order to complete Phase II, the PVPC contracted with Vanase Hangen Brustlin, Inc., Holden Engineering and Surveying, Inc., and Margo Jones, Architects to accomplish all the required work items. Each of these consultants prepared separate reports pertaining to their respective task. Portions of these reports have been used to complete this plan.



Jacob's Ladder Trail Scenic Byway
Improvements Plan: Phase II
Location of
Scenic Byway Improvements
Proposed Project
State Forest
0
5
10
15
20
25 miles
NORTH
Lee Turn-out
Becket Turn-out
Retaining Wall
Chester RR Depot
Maple St. Bridge
Chester Jail
Chester Turn-out
Huntington Turn-out
Retaining Walls
Russell Turn-out
LEE
BECKET
MIDDLEFIELD
CHESTER
HUNTINGTON
MONTGOMERY
RUSSELL
BLANDFORD
OTIS
TYRINGHAM
October Mountain State Forest
Beartown State Forest
Becket State Forest
Chester-Blandford State Forest
H.G. Fox State Wildlife Management Area
HAMPSHIRE COUNTY
HAMPDEN COUNTY
BERKSHIRE COUNTY
MASS. TURNPIKE
Goose Pond
Littleville Lake
Cobble Mountain Reservoir
Otis Reservoir
West Branch
Westfield River
20
90
102
8
112
66
23

Figure 1.

Highway and Safety Analysis

The Phase I analysis examined the existing physical and operational characteristics along the corridor. This Phase II report describes the expected future travel conditions as a result of the increase in tourist travel along the corridor. This section presents a discussion on the results of the travel forecasts and the criteria used in assessing the anticipated future travel conditions. It also identifies problem areas and includes a series of long term recommendations to ensure that the roadway continues to operate in a safe, efficient manner. The designation of the Jacob's Ladder Trail as a Scenic Byway may change the role of the roadway from one which serves an accessibility role carrying traffic between two points, to that of a recreational role where vehicles are encouraged to stop at rest areas and historic sites along the roadway. It is important that the roadway continue to provide safe, efficient travel conditions to facilitate the enjoyment of the surrounding environment in the future.

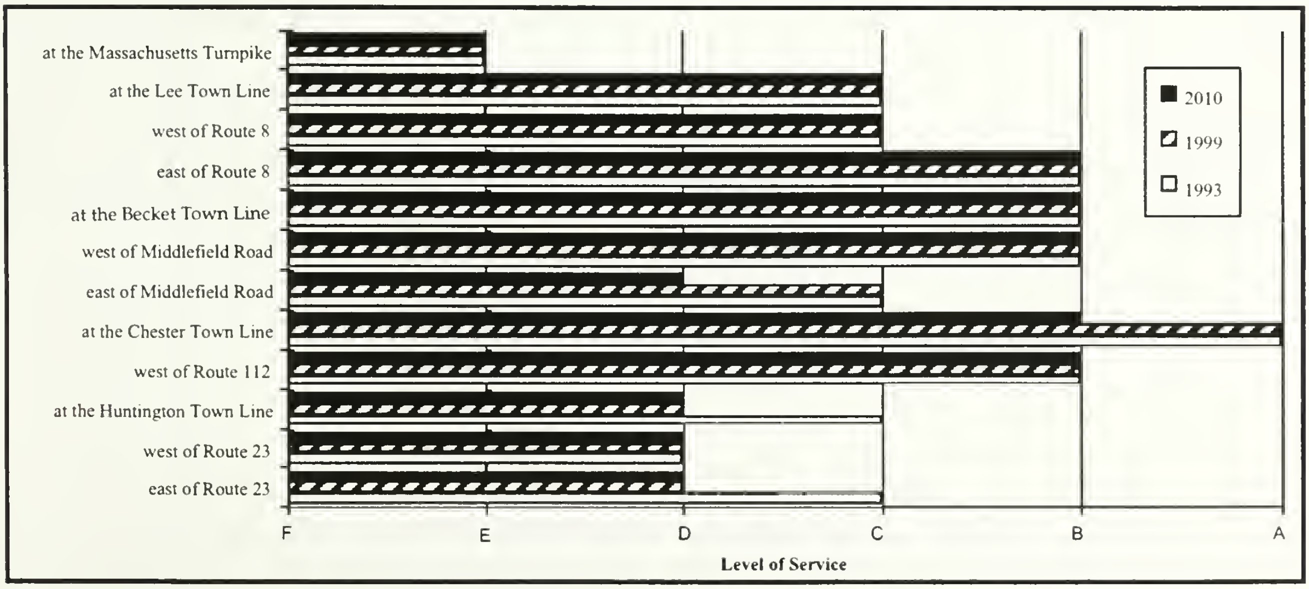
Level of Service

Projected future traffic volumes were compared to the calculated service flow volumes for the entire Jacob's Ladder Trail Corridor. The resulting Level of Service (see Appendix A for definition of Level of Service) for each segment under all three analysis years is shown in Figure 2.

As can be seen from the figure, the majority of the roadway segments are expected to operate at Level of Service "C" or better for all three analysis years. The one exception is the segment in the vicinity of the Massachusetts Turnpike which is expected to operate at Level of Service "E" during the peak 15 minute period of all three analysis years. The Berkshire Regional Planning Commission has identified the need for improved access to the turnpike in this area and any improvement is expected to be advanced through their Regional Transportation Plan.

The corridor is also expected to operate in the Level of Service "D" range in the town of Russell east and west of Route 23 and at the Huntington Town Line. The deterioration of these segments is of some concern, however, as the intent of the roadway is mainly for scenic and recreational purposes. While safe, efficient traffic operations are expected, high travel speeds are neither expected nor desired. Based on the traffic counts, it appears these segments may experience greater congestion during the peak commuting hours (7 AM to 9 AM and 4 PM to 6 PM) but operate at acceptable levels during the rest of the day. This segment should continue to be monitored in the future to determine if additional capacity is required.

Figure 2. - *Jacob's Ladder Trail Level of Service Results*



Pavement Management

A pavement conditions analysis was performed along the entire length of the corridor as part of the existing conditions analysis. The results of this analysis indicate that the pavement, on a whole, is in generally good condition throughout the corridor. Currently, Route 20 is classified as a Rural Minor Collector and is eligible for funding under the Surface Transportation Program (STP). Under the requirements of Intermodal Surface Transportation Efficiency Act (ISTEA) all STP roadways must be part of an approved pavement management system by October 1997. The Pioneer Valley Planning Commission is currently in the process of initiating their pavement management system to meet the ISTEA requirements. The entire Route 20 corridor in Russell, Huntington, and Chester will be included as part of this system and resurveyed before the 1997 deadline. In addition, the corridor will be reexamined at a minimum of every three years in order to determine the pavement conditions in the area. The data collected as part of the Pavement Management System (PMS) will be submitted to the State and used to assist in the selection of pavement projects for the current Transportion Improvement Plan (TIP). For local roadways which are not eligible for state funding and provide access to the Route 20 corridor, it is recommended that a pavement management system, such as a detailed inventory of existing pavement conditions, be implemented on the local level.

Bridge Management

Five bridges were identified in the study area as part of the existing conditions analysis which are either structurally deficient or approaching deficiency. The Sanderson Brook Bridge (# C11029) in Chester has the worst rating and should be recommended for replacement in the Transportation Improvement Program (TIP). All recommendations proposed in the previous document are still valid. The Massachusetts Highway Department (MHD) policy for bridge widths on arterial highways should be followed in the future along the corridor. In addition, provisions should be made for sidewalks and aesthetic bridge railings in future bridge construction or improvement projects along the roadway.

Safety Management

Currently, several sections of the roadway experience accident rates which are higher than the national average for minor arterial roadways. In addition, over thirty percent of all accidents along the corridor involve only one vehicle. This could be indicative of high travel speeds in combination with poor physical operating conditions resulting from the rolling to mountainous terrain along the corridor. The creation of a safety management program along the corridor would be very beneficial in identifying problem areas. Following is more detail on the information which should be collected as part of a safety management program.

Pavement Markings

The centerline markings along the corridor are in good condition and appear to have been recently updated in some areas. Single white edge lines however, have been neglected and are faded beyond recognition in most areas. Edge lines are important as they define the edge of the travel lane for motorists and provide guidance on the distance to the edge of pavement and lateral obstructions along the side of the roadway. In the short term, the edge lines should be replaced with reflectorized, white thermoplastic markings. In the long term, the conditions of all pavement markings along the corridor should be inventoried on a regular basis (once per year) to determine the need for replacement in certain areas.

Obstructions

The openings on some existing catch basin covers are aligned vertically in several areas, creating a hazardous condition for bicyclists along the corridor. An inventory of the byway revealed a total of eighty-two catch basins, north and south bound, which need realignment (see Appendix B for

inventory). Based on MHD District #1 price estimates for catch basin grate, frame and cover replacement, it will cost approximately $294.54 to fix each basin for a total of $24,152 to correct all problem basins. This improvement is critical to provide a safe environment for bicyclists along the corridor.

The distance of obstructions along the side of the roadway have a tendency to cause motorists to drive closer to the center of the pavement. This brings vehicles closer to those in the opposite travel lane, causing a decrease in speeds and higher potential for accidents. One treatment to provide a greater distance between vehicles and lateral obstructions is the provision of wider shoulder along the roadway. This treatment is not always feasible or practical, particularly along a scenic byway where it is important to preserve the natural beauty of the surrounding terrain to the extent possible. Instead, existing obstructions should be identified through regulatory and warning signs, allowing driver's to adjust their speed accordingly. In addition, obstructions such as utility poles, mailboxes, and signage should be set back from the roadway where possible. The corridor should be inventoried to determine the location of lateral obstructions to motor vehicle traffic. In addition, this inventory should be updated at least once every three years.

Signage

The installation of regulatory and warning signs at strategic points along the roadway is an effective means of alerting motorists to upcoming changes in the roadway. The Manual on Uniform Traffic Control Devices (MUTCD) provides standards for the signing of public highways. While the existing corridor provides good, consistent signing throughout the study area, it is important to monitor the location and function of the existing sign system in order to continue to provide motorists with information in the most effective manner.

As mentioned previously, the designation of the study area as a scenic byway is expected to result in an increase in recreational traffic along the roadway, requiring informational and guide signing for motorists. It is important that the need for additional signing is prioritized by location so that motorists are not overloaded by an abundance of information in one area. The location of all new information and guide signs should not interfere with the placement and function of existing regulatory and warning signs along the roadway.

An inventory of the existing sign system should be conducted. As part of this inventory, locations in which existing signs have been damaged, vandalized, or obscured by vegetation should be identified. In addition, the inventory can be used to assist in the best possible location of all future signing along the corridor.

Corridor Management

Currently, the Jacob's Ladder Trail carries basically light traffic with few operational problems. However, the existing terrain along the corridor is classified almost entirely as either rolling or mountainous. When combined with an increase in slower moving, recreational traffic this classification could cause difficulties in passing and turning movements in the future. Environmentally friendly treatments may be required, such as the use of existing and proposd turn-outs to allow slower moving vehicles the opportunity to pull off of the roadway to permit faster vehicles to pass.

Intersection Improvements

As the corridor continues to grow, it is important to consider the ability of traffic to enter and exit the roadway in an orderly fashion. The projected increase in through traffic along the roadway could result in longer delays for exiting side street traffic. This leads to driver frustration, causing motorists to accept smaller gaps in the traffic stream, and potentially increasing the number of angle collisions in the future.

The following presents more information on specific treatments to reduce delay and increase safety at the unsignalized locations along the corridor.

Stopping Sight Distance

Stopping sight distance can be divided into two separate categories; approach stopping sight distance and exiting stopping sight distance. Approach stopping sight distance is the distance required for an approaching driver to perceive and react accordingly to an exiting vehicle. Exiting stopping sight distance represents the time to (1) turn left or right and accelerate to the operating speed without causing approaching vehicles to reduce speed by more than 10 miles per hour, and (2) upon turning left, to clear the near half of the intersection without conflicting with the vehicles approaching from the left.

Exiting sight distance relates to driver comfort, both for the motorist exiting the minor street and the motorist on the major street who may need to adjust his speed in response to the exiting vehicle. Approach stopping sight distance is generally more important as it represents the minimum distance required for safe stopping while exiting stopping sight distance is based only upon acceptable speed reductions to the approaching traffic stream.

When a grade exists, as in many locations along the corridor, correction factors are applied. Generally, there is sufficient sight distance on a downhill grade, and sight distance restrictions on an uphill grade. Signs and landscaping in the vicinity of intersections should be kept low to the ground to assist in the maintenance of good sight distance along the corridor.

Retaining Walls

The Pioneer Valley Planning Commission contracted with consulting engineers Vanasse Hangen Brustlin, Inc. (VHB, Inc.) to assess three deteriorating retaining walls along the corridor. These existing precast concrete crib retaining walls are located at mile marker 43.9 of Jacob's Ladder Trail (Route 20) in Russell, mile marker 43.1 in Russell/Huntington and mile marker 34.0 in Chester. The intention was to identify and recommend solutions for the current wall deficiencies at these locations while maintaining the scenic appearance of Jacob's Ladder Trail. It was also intended to set a precedent for future wall replacement projects on Jacob's Ladder Trail by providing the Massachusetts Highway Department with a prioritization of replacement alternatives.

Field Observations

All three walls are constructed similarly using precast concrete crib units. The units are created by stacking precast lengths of concrete members in a square pattern. The pieces are individual, not tied together. Fill material is placed inside the units, which acts as a stabilizer. The wall's strength is dependent on the compaction of this material and the interlocking of the concrete elements.

In this type of retaining wall system, tree roots can augment its deterioration. As the root system grows, the individual members are pushed out of their intended alignment, undermining the integrity of the wall's stability. Water infiltration into the members also causes deterioration. The trapped water freezes, expands and then thaws. This movement causes concrete to crack and become loose. The use of salt in the wintertime to treat icy roadway conditions accelerates the corrosion of the wall. In particular, the steel reinforcing bars used to strengthen the individual elements are affected. The current deterioration will continue over time. More members will become loose, causing others to collapse. Changes in the structure will occur slowly, since it is primarily due to weathering.

Despite the similarity of the walls, existing conditions vary. Following is a more detailed description of each wall.

Russell

Located at mile marker 43.9, this wall is approximately eleven feet high and thirty feet long. Located on the western side of Route 20, this wall appears to be in fair to poor condition. Units are stacked symmetrically and have retained their horizontal and vertical alignments. Voids in the backfill material have formed over time, as well as the growth of trees.

Several members have eroded. A potential cause is water infiltration into the members, resulting in pieces of concrete spalling off of members. It is also possible that car or truck impacts have knocked off pieces of the concrete members. There are some elements with exposed reinforcing bars. The exposed surfaces of the bars are rusted; some bars appear to be broken off completely.

At the top northeast corner, an element is missing, and its sister member appears to be loose. Exposed ledge is adjacent to the wall in the southeast side. It is within ten feet of the edge of pavement. More ledge is visible to the north of the existing wall.

Mile Marker 43.9 Russell

Mile Marker 43.9 Russell

Russell/Huntington

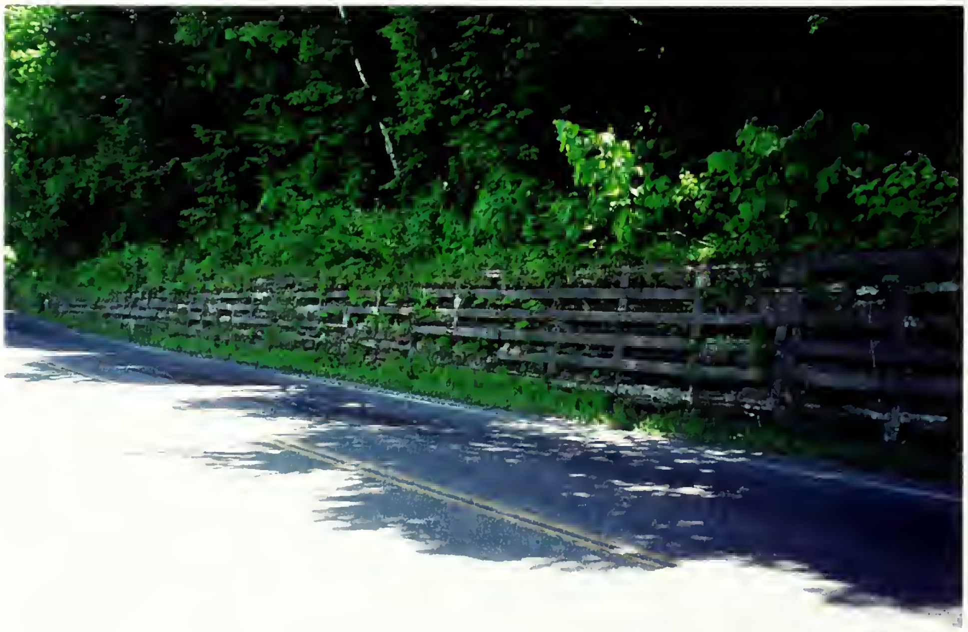
Located at mile marker 43.1, on the western side of Jacob's Ladder Trail, this concrete crib wall ranges in height from four to seven feet and is approximately 415 feet in length. It is an unsightly, dilapidated structure which is in poor condition along its entire length. On the east, this wall abuts a stone wall that is to remain. At the junction of the two walls, the concrete members of the crib wall appear to be in very poor condition. Large portions of concrete have spalled off. At the spall locations, exposed steel reinforcing is significantly rusted and there are a few broken bars. The backfill material

is nonexistent. Proceeding westerly, the wall continues in a similar state. Most exposed elements are severely deteriorated with rusted steel reinforcing bars protruding through the concrete. This has also caused staining of the concrete. One portion of the wall has experienced horizontal and vertical movement. Elements are completely crushed or broken into fragments. At the west end of the wall, the backfill material has also eroded to the degree of being nonexistent. In addition to the questionable stability of the wall, its abrupt ending is not acceptable to Massachusetts Highway Department standards.

Mile Marker 43.1 Russell/Huntington

Mile Marker 43.1 Russell/Huntington

Mile Marker 43.1 Russell/Huntington



Mile Marker 43.1 Russell/Huntington

Chester

Located at mile marker 34.0, on the western side of Route 20, this retaining wall is in poor condition. It ranges in height from three to seven feet and is approximately 375 feet in length. On the southerly end of the retaining wall, the entire unit is exposed on three sides. This exposure indicates that the structure is unnecessary. Rocks and boulders are present in this area. The wall has some missing elements, the majority of the members are severely deteriorated and several pieces are cracked and broken. Portions of the members have exposed steel reinforcing bars, which are severely rusted. A few members have also rotated forward and appear to be falling. Members have collapsed, causing

horizontal and vertical movement. The surrounding landscape revealed that a swale has formed or was constructed behind the retaining wall. Because of the swale, the height of the soil behind the wall is lower than the height of the top of the wall. In effect, the top portion of the existing wall is unnecessary. Proper site work and grading would eliminate the need for a retaining wall 375 feet in length and in its place a shorter 160 foot wall where there is an area of steep slope.

Mile Marker 34.0 Chester

Mile Marker 34.0 Chester

Mile Marker 34.0 Chester

Mile Marker 34.0 Chester

Mile Marker 34.0 Chester

Mile Marker 34.0 Chester

Removal

Removal of the walls in all three locations will involve similar construction methods and sequencing. A traffic management program must be implemented to keep vehicle travel continuous. The walls will be dismantled and removed in bulk by the necessary construction equipment. Debris will be removed and disposed of properly.

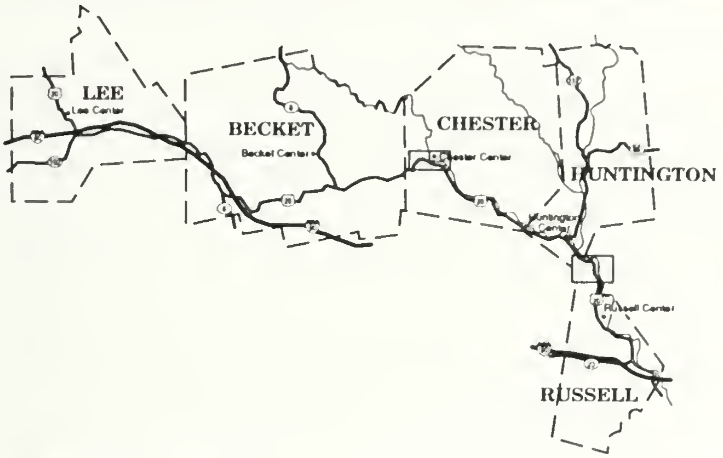
Due to the unknown soil conditions and the probable presence of ledge at the wall locations, the exact removal methods cannot be specified. Sheeting may be necessary to maintain slope stability in the locations of large changes in height, particularly in Russell. In several places, at all three wall locations, tree removal may and brush removal will be necessary. All underground utilities and drainage systems in the vicinity of the walls must be identified, protected and kept in operating condition during any construction.

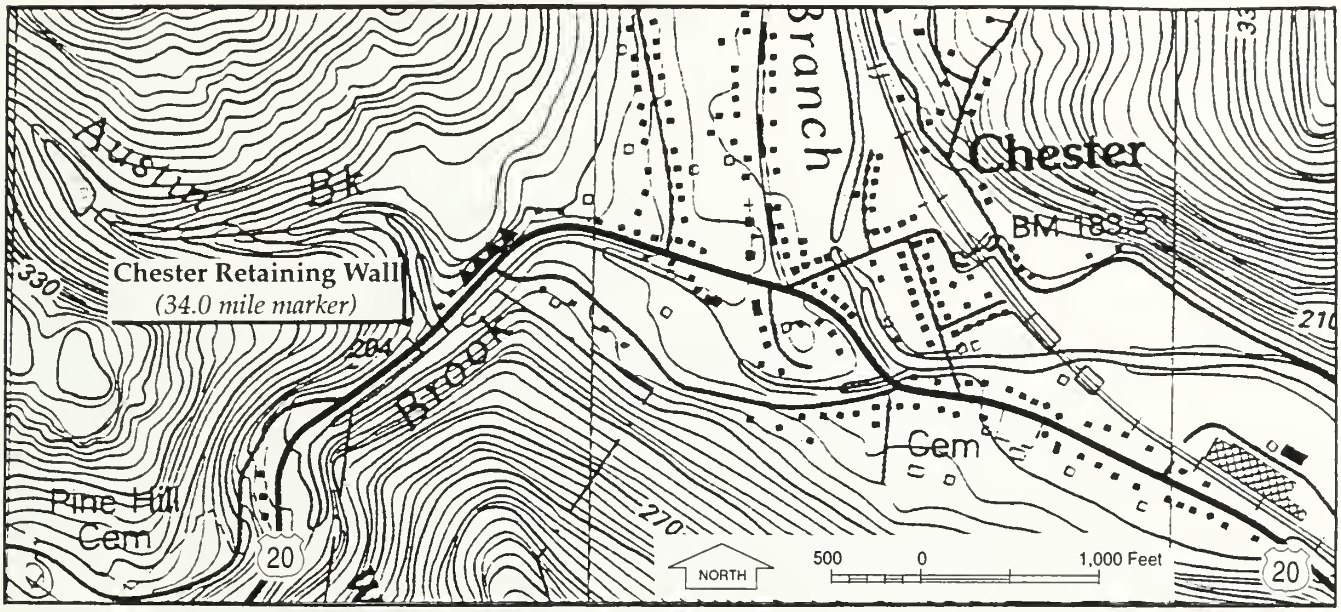
The actual demolition cost estimates vary depending on wall location. Factors affecting this include height, length, ledge, slope and proximity to pavement. These estimates are as follows:

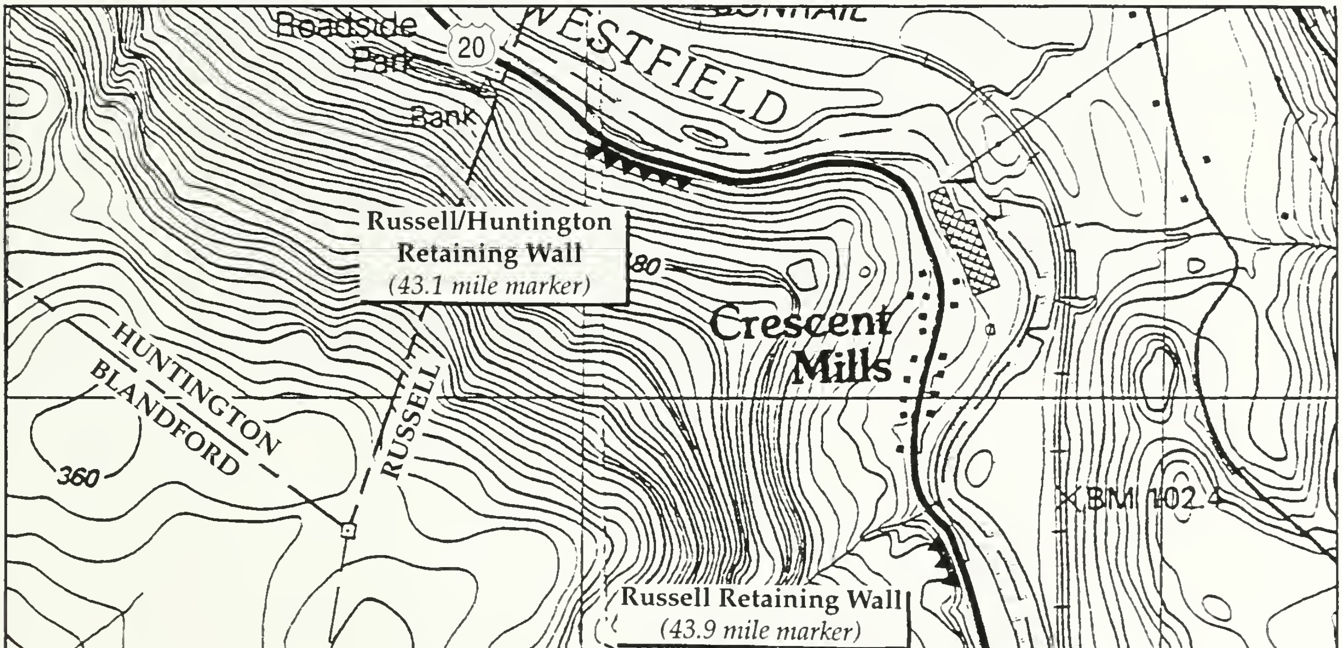
Russell	$10,000
Russell/Huntington	$30,000
Chester	$25,000.

Proposed Retaining Walls

Vanasse Hangen Brustlin, Inc. was directed to assess a variety of retaining wall options to present to the Jacob's Ladder Trail Advisory Committee for preferential selection. This included cemented stone masonry wall, stone veneer wall, precast concrete bin wall, precast concrete T-wall, cast-in-place concrete cantilever wall, evergreen wall and loose or dry stone wall. With the exception of the latter, all of these types of retaining walls have been previously approved by the Massachusetts Highway Department for use on other state funded and maintained roadways. Loose or dry stone walls are not acceptable according to Massachusetts Highway Department safety standards because of the crumbling potential of the wall upon impact from a vehicle. Rock-filled gabion walls were not a desirable alternative of the advisory committee and therefore were not assessed.


LEE
Lee Center
BECKET
Becket Center
CHESTER
Chester Center
HUNTINGTON
Huntington Center
Russell Center
RUSSELL


Chester Retaining Wall
(34.0 mile marker)
Austin Bk
Brook
Branch
Chester
BM 183.5
Cem
Pine Hill Cem
20
NORTH
500
0
1,000 Feet


Roadside Park
Bank
WESTFIELD
20
Russell/Huntington Retaining Wall
(43.1 mile marker)
Crescent Mills
HUNTINGTON
BLANDFORD
RUSSELL
360
BM 102
Russell Retaining Wall
(43.9 mile marker)
240
500
0
1,000 Feet

Cemented Stone Masonry Retaining Wall and Stone Veneer Wall

This classic, picturesque wall is commonly found along byways of this caliber. Cemented stone masonry walls are modeled after the old property line and corral walls used by farmers to designate land areas. Those walls were placed lose, with only the weight of the stone holding them together. The addition of mortar creates a more solid structure, making it an acceptable earth retention system.

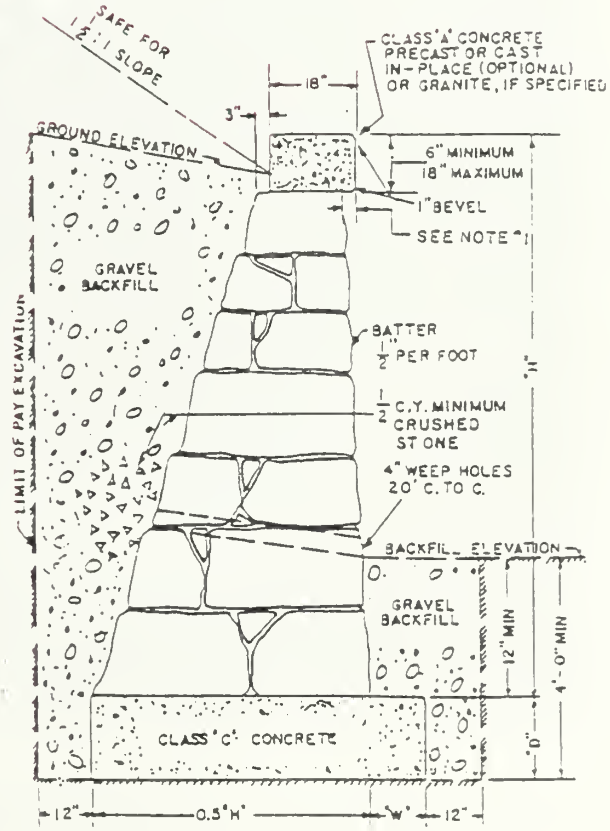
The wall's shape, in section, is wider at the bottom than at the top. This shape constitutes a gravity wall. Non-reinforced concrete foundations are first cast-in-place. Fieldstones, held together with mortar, are stacked to the desired height, then the wall is capped with a flat piece of stone, typically granite or concrete. Backfill is subsequently placed and compacted.

Because of the care required in the placement of the stones and the involvement of cast-in-place foundations, this type of wall can be costly. It easily creates the desired image, one of untouched nature, yet it's solidity and massive appearance promotes a feeling of safety for the driver.

Stone veneer walls are similar in appearance to the stone masonry wall, but rather than use stone as the main structure of the wall, it is merely applied as a facing to a cast-in-place concrete wall. These walls portray a similar image as the stone masonry wall but are somewhat more "finished" in appearance.

Cemented Stone Masonry Wall

Cemented Stone Masonry Wall



Cemented Stone Masonry Wall

Precast Concrete Bin Wall

This style wall is very modern in appearance. It has a finished look of uniformity, regularity and cleanliness. Since it is manufactured at a precast facility, color enhancers and textures can be added to the concrete and forms to customize it's demeanor.

Square or rectangular walled units, open top and bottom, are cast in a factory, ready for shipment. Units are shipped to the site, where they are installed using a minimum of equipment. They are placed on continuous concrete leveling pads. Backfill is placed and then compacted within the bin.

Precast bin walls are considered gravity retaining walls since their base dimension is similar to that of the cemented stone masonry retaining walls.

Precast Concrete Bin Wall

Precast Concrete T-Wall

T-walls are similar in appearance to the bin wall previously described. Modern, clean and strong are all applicable descriptions. The panels tend to be large, causing finished walls to seem monolithic. Additives to enhance color and texture can be added to the concrete mixtures for this type of wall.

Each piece consists of a flat face panel with a vertical stem. The foundation required is the placement of concrete leveling pads. Walls are constructed, then backfill is placed behind the wall, which is then compacted. Similar to cemented stone masonry walls and bin type walls, T-walls are a variation of the gravity wall. The bottom course width, in section, is approximately the same as that of other gravity walls.

This type of wall is more economical than the bin style wall because it incorporates less concrete. Again, in their finished state, they can appear austere.

Precast T-Wall

Precast T-Wall

Cast-in-Place Concrete Gravity Retaining Wall with Textured Finish

This type of wall can attain several desired finished appearances. Alternatives include a wood grain finish, a stone finish or varying concrete block shapes. The pattern is incorporated into the form work of the cast-in-place wall and can be customized almost infinitely. Colors can also be added to the concrete mixture to obtain the desired impression.

The wall's shape, in section, is wider at the bottom than at the top. This type of wall is constructed entirely at the site, with the concrete cast-in-place. Depending upon the height of the wall, foundations are used as required. The width of the base of the wall is comparative to that of other gravity retaining walls, such as cemented stone masonry and precast concrete bin walls. Steel reinforcing bars are incorporated into the design for temperature and shrinkage purposes only. Form work frames the cast concrete, shaping the wall. Inside these forms, rubber liners can mold a pattern into the face of the wall. Once the forms and liners are removed, the wall is left with a textured surface. Backfill is subsequently placed and compacted.

Because of the intense labor requirement of cast-in-place work, this type of wall can be costly. The wall can emulate natural stone, creating the desired integrated environmentally conscious image. Similar to the stone masonry wall, it's solidity promotes a feeling of safety for the driver.

Cast-in-Place Concrete Cantilever Retaining Wall with Textured Finish

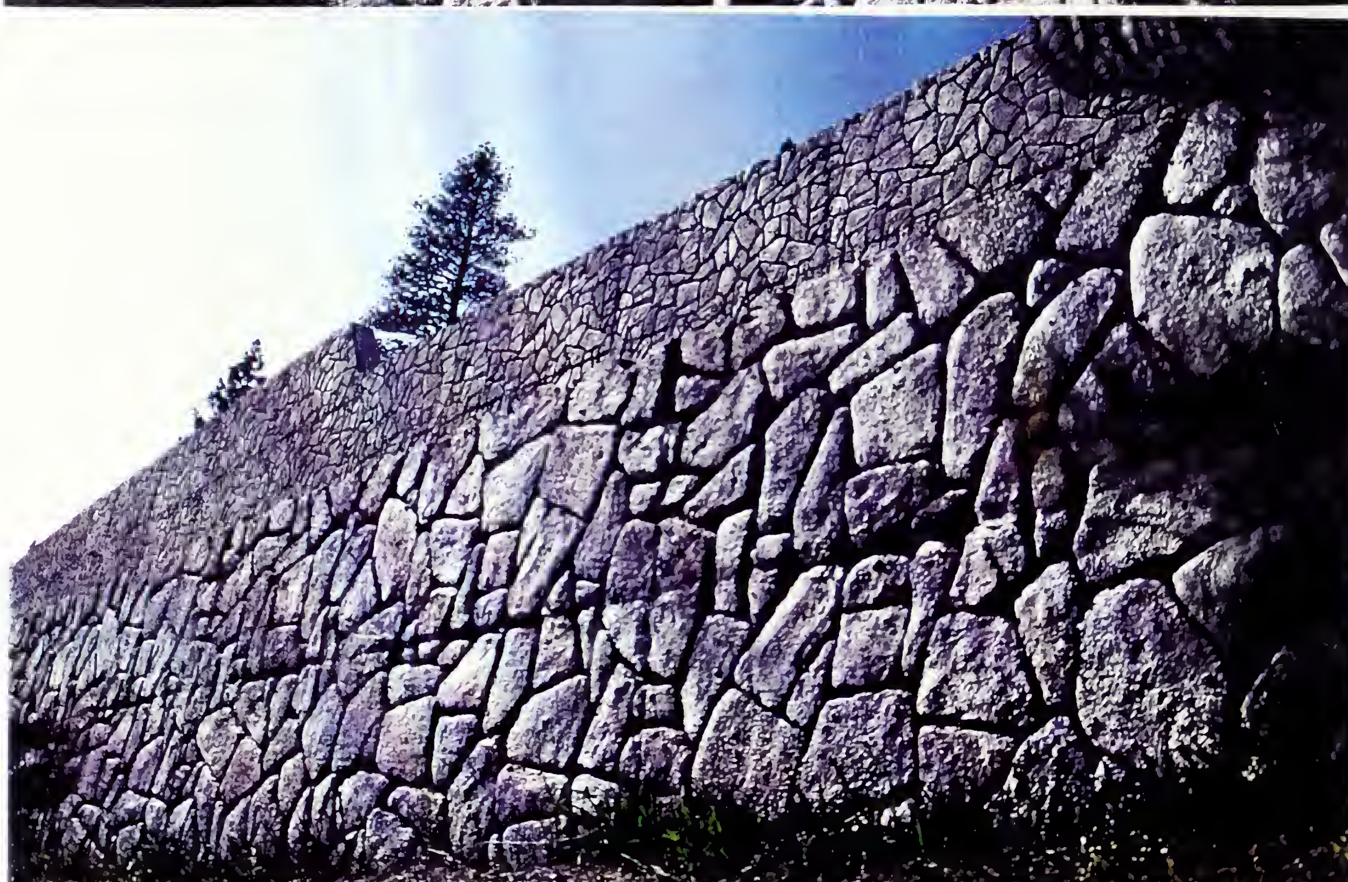
Cantilever cast-in-place concrete walls can also be built in a customized fashion. Form liners and colored additives in the concrete mixture have the potential to significantly affect the final appearance of the retaining wall. It is possible to have the wall face resemble a wood grain or stone finish or varying concrete block shapes.

Cast-in-place Gravity Wall

Cast-in-place Gravity Wall

Cantilever walls are made up of two components: a rectangular horizontal footing and a rectangular vertical stem. The stem is of uniform thickness and contains steel reinforcing bars for strength. Stem and foundation are held together with additional reinforcing. They are constructed entirely in the field with cast-in-place concrete. Forms can have liners to acquire the desired texture.

This type of wall contains less concrete than gravity walls because of the addition of structural reinforcing bars. Due to the labor of cast-in-place, this type of wall can be costly. A cantilever retaining wall is versatile in that it can take on any appearance. The wall can emulate natural stone or wood, creating the desired "in harmony with nature" concept. Similar to the stone masonry wall, it's solidity promotes a feeling of safety for the driver.



Cast-in-place Wall with Textured Finish

Cast-in-place Wall with Textured Finish

Evergreen Wall

Evergreen walls are precast concrete units, when stacked upon each other they form a structure that allows vegetation to grow and eventually cover the face of the wall. Potentially, these walls can be covered so that the concrete members are disguised. However, without proper landscaping and maintenance, they can become overgrown and unsightly.

Precast concrete members are formed and finished in a manufacturing plant, then brought to the site. A cast-in-place footing supports the units. They are carefully installed and aligned. After being joined together, they are filled with compacted material.

Finished installations are very uniform and symmetrical in appearance. In fact, they resemble the precast concrete crib walls currently in use at the subject locations. Considering their modern, regular pattern, the walls create their own impression, rather than working to enhance the natural aesthetics of the immediate area.

Evergreen Wall

Committee Preference

Upon review of the alternatives presented by Vanasse, Hangen Brustlin, Inc., the Jacob's Ladder Trail Scenic Byway Advisory Committee formally rated and ranked, in order of preference, the top three retaining wall alternatives to be used in the future reconstruction of the three existing dilapidated retaining wall structures on the corridor. These choices, from first choice to third choice, were cemented stone masonry wall, cemented stone veneer wall and evergreen wall.

Construction Estimates and Design Parameters

The Massachusetts Highway Department requires soil borings at fifty foot intervals along each wall. From this type of testing, information on the soil is obtained to determine its strength capacities. The design of the walls is dependent upon the type of soils present at each location. Another parameter determined from these tests is the location of ledge. Surface evidence suggests the shallow presence of rock at the location of each of the walls. Special design considerations must be made to accommodate the possibility of seating the walls on ledge.

Evergreen Wall

The Massachusetts Highway Department suggested procedure for the construction of new retaining walls includes, at a minimum, the following items: design consultant selection, design development, interpretation of soil boring information, development of a complete construction package, advertising for bid, contractor selection, mobilization and finally construction. The construction document package, prepared and certified by a Commonwealth of Massachusetts Registered Professional Engineer, includes drawings, specifications and quantity estimates. This stepped design approach accommodates the Massachusetts Highway Department review and allows for the incorporation of field conditions determined during final design.

The construction costs of the proposed retaining wall options vary considerably. Some options, although more costly per linear foot, may prove to be the most economical due to height considerations. The following table summarizes this cost.

Table 1. Approximate Cost per Linear Foot.

Retaining Wall Type	Economical Height Range (above grade)	Cost Per Linear Foot (6 foot exposed)
Cemented Stone Masonry	< 12 ft.	$175.00
Cemented Stone Veneer	< 12 ft.	$225.00
Precast Concrete Bin	8 ft. - 24 ft.	$175.00
Precast Concrete T-wall	8 ft. - 18 ft.	$150.00
Cast-in-Place Concrete Gravity	< 12 ft.	$200.00
Cast-in-Place Concrete Cantilever	< 12 ft.	$200.00
Evergreen	8 ft. - 30 ft.	$175.00

Source: Weighted Average Bid Prices Statewide and by Districts from Highway and Bridge Projects, MHD 1993.

Tables 2 - 4 provide detailed estimated construction costs of the top three alternatives for each of the project locations on the corridor. These costs include design, soil borings, demolition and removal of the existing wall including disposal, construction monitoring, excavation and related construction activities. The preferred option of a cemented stone masonry wall is actually one of the more cost effective alternatives. The total cost for all three retaining walls for reconstruction as a cemented stone masonry wall is approximately $ 410,000. The wall at mile marker 43.9 in Russell will cost $ 42,700, with the other two walls in Russell/Huntington and Chester costing $ 226,000 and $ 142,000 respectively.

Table 2. Estimated Construction Cost of Russell Retaining Wall Replacement.

	Russell: Length - 30 feet; Height - 11 feet		
Item	**Cemented Stone Masonry**	**Cemented Stone Veneer**	**Evergreen**
Design	$3,000	$3,000	$3,000
Soil Borings	$3,000	$3,000	$3,000
Demolition	$10,000	$10,000	$10,000
Retaining Wall	$9,600	$12,400	$9,600
Excavation, Backfilling, Construction Sequencing	$8,500	$8,500	$8,500
Construction Services	$1,500	$1,500	$1,500
Subtotal	$35,600	$38,400	$35,600
Contingencies	$7,100	$7,700	$7,100
Total	**$42,700**	**$46,100**	**$42,700**

Table 3. Estimated Construction Cost of Russell/Huntington Retaining Wall Replacement.

	Russell/Huntington: Length - 415 feet; Height - 4 to 7 feet		
Item	**Cemented Stone Masonry**	**Cemented Stone Veneer**	**Evergreen**
Design	$10,500	$10,500	$10,500
Soil Borings	$7,500	$7,500	$7,500
Demolition	$30,000	$30,000	$30,000
Retaining Wall	$85,000	$109,000	$85,000
Excavation, Backfilling, Construction Sequencing	$50,000	$50,000	$50,000
Construction Services	$5,000	$5,000	$5,000
Subtotal	$188,000	$212,000	$188,000
Contingencies	$38,000	$42,000	$38,000
Total	**$226,000**	**$254,000**	**$226,000**

Table 4. Estimated Construction Cost of Chester Retaining Wall Replacement.

Chester: Length - 160 feet (375 lf removed); Height - 4 to 7 feet)			
Item	**Cemented Stone Masonry**	**Cemented Stone Veneer**	**Evergreen**
Design	$9,500	$9,500	$9,500
Soil Borings	$6,000	$6,000	$6,000
Demolition	$25,000	$25,000	$25,000
Retaining Wall	$33,000	$42,000	$33,000
Excavation, Backfilling, Construction Sequencing	$40,000	$40,000	$40,000
Construction Services	$4,500	$4,500	$4,500
Subtotal	$118,000	$127,000	$118,000
Contingencies	$24,000	$25,000	$24,000
Total	**$142,000**	**$152,000**	**$142,000**

Guard Rails

The Pioneer Valley Planning Commission contracted with consulting engineers Vanasse Hangen Brustlin, Inc. to provide an assessment of guard rail alternatives including conceptual drawings and replacement costs. Specifically, the intention is to maintain the picturesque nature of the highway by replacing the existing standard steel guard rails on an as needed basis with aesthetically pleasing guard rails.

The general design speed along Jacob's Ladder Trail (Route 20) is predominately 50 - 55 miles per hour. Exceptions occur in the village areas and along narrow or winding stretches of roadway. It is these speeds, assigned by the Massachusetts Highway Department, that determine the types of guard rails that are considered to be safe. The Federal Highway Administration (FHWA) recently completed a study of guard rails and walls. The aesthetic guard rails included in this report were approved and tested under the National Cooperative Highway Research Program (NCHRP) #230. The same guard rails are being tested under a new standard, NCHRP #350. Once the results from that study are published, they will be reviewed to determine whether the guard rails discussed in this report are still considered acceptable.

Proposed Proposed Guard Rails and Walls

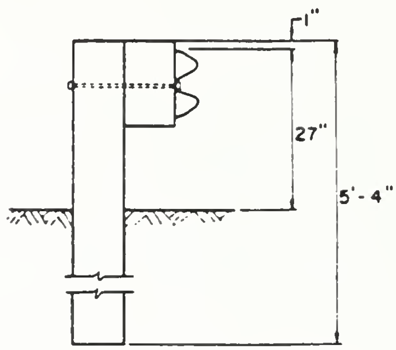
Six different types of guard rails and walls were assessed. This included standard steel guard rail with steel posts, standard steel guard rail with wood posts, weathering steel guard rail with wood posts, steel backed timber guard rail with wood posts, precast simulated stone guard walls and stone masonry guard walls. Guard rails and walls function similarly in regard to safety, however, their appearance is markedly different. A description of each follows.

Standard Steel Guard Rail with Steel Posts

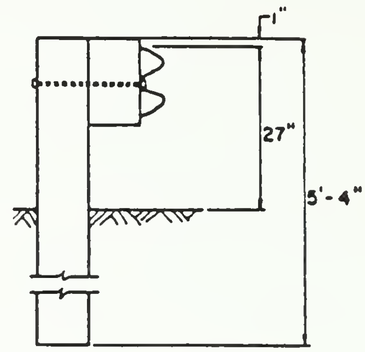
The most common guard rail in Massachusetts, this type of rail system is not visually appealing. However, it is the most economical safety improvement available that is approved by the Federal Highway Administration.

Steel Backed Timber Guard Rail with Wood Posts

This rail is constructed of pressure treated wooden members with steel plates bolted onto one side. The rail is then attached to pressure treated wooden posts, which have been driven into the ground. Since the elements subjected to view are wood, this type of rail does not detract from the surroundings. The steel plate strengthens the horizontal wooden member, which enables it to successfully pass the tests in the National Corporative Highway Research Program study and to obtain its crash tested status. This system has not been used in the Commonwealth of Massachusetts at this time. It is currently in use on southern Connecticut scenic roadways and in portions of New Hampshire.



G4(1W)



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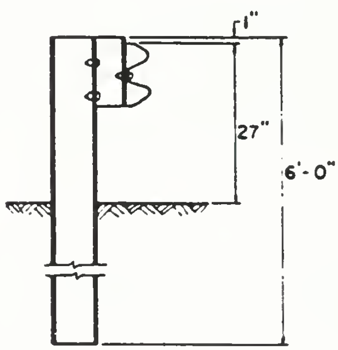
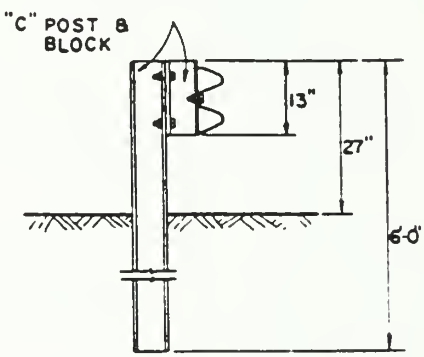


G4(1S)

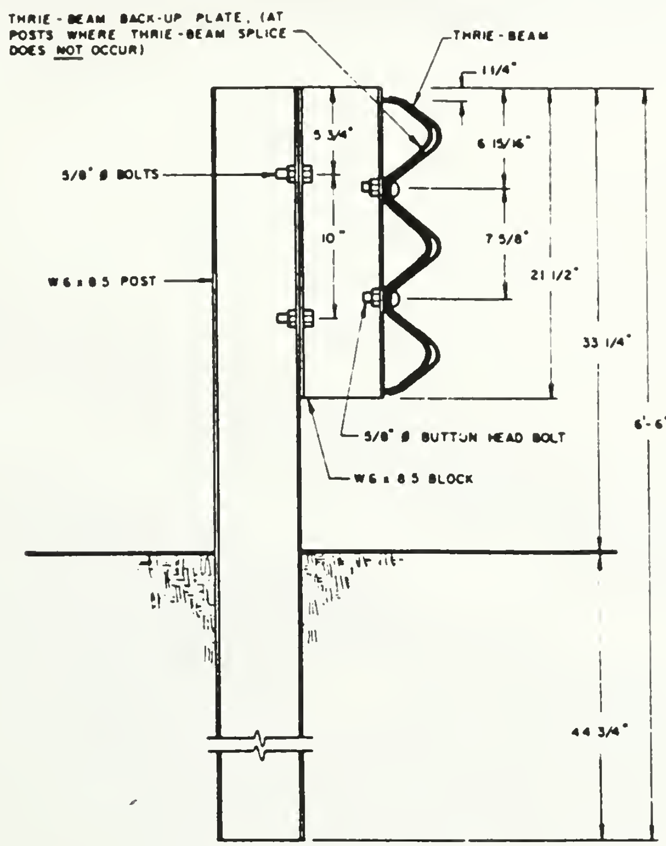


G4(2S)

ASSHTO Designation varies with post type as noted below

Post Type	G4(1W)—8″ × 8″ Wood G4(2W)—6″ × 8″ Wood G4(1S)—W6 × 8.5 steel G4(2S)—4 1/3″ × 5 5/8″ × 3/16″ "C" steel post
Post Spacing	6′ 3″
Beam Type	12 gauge W-beam
Nominal Barrier Height	27″
Maximum Dynamic Deflection	approximately 3′

Standard Steel Guard Rail With Steel Posts

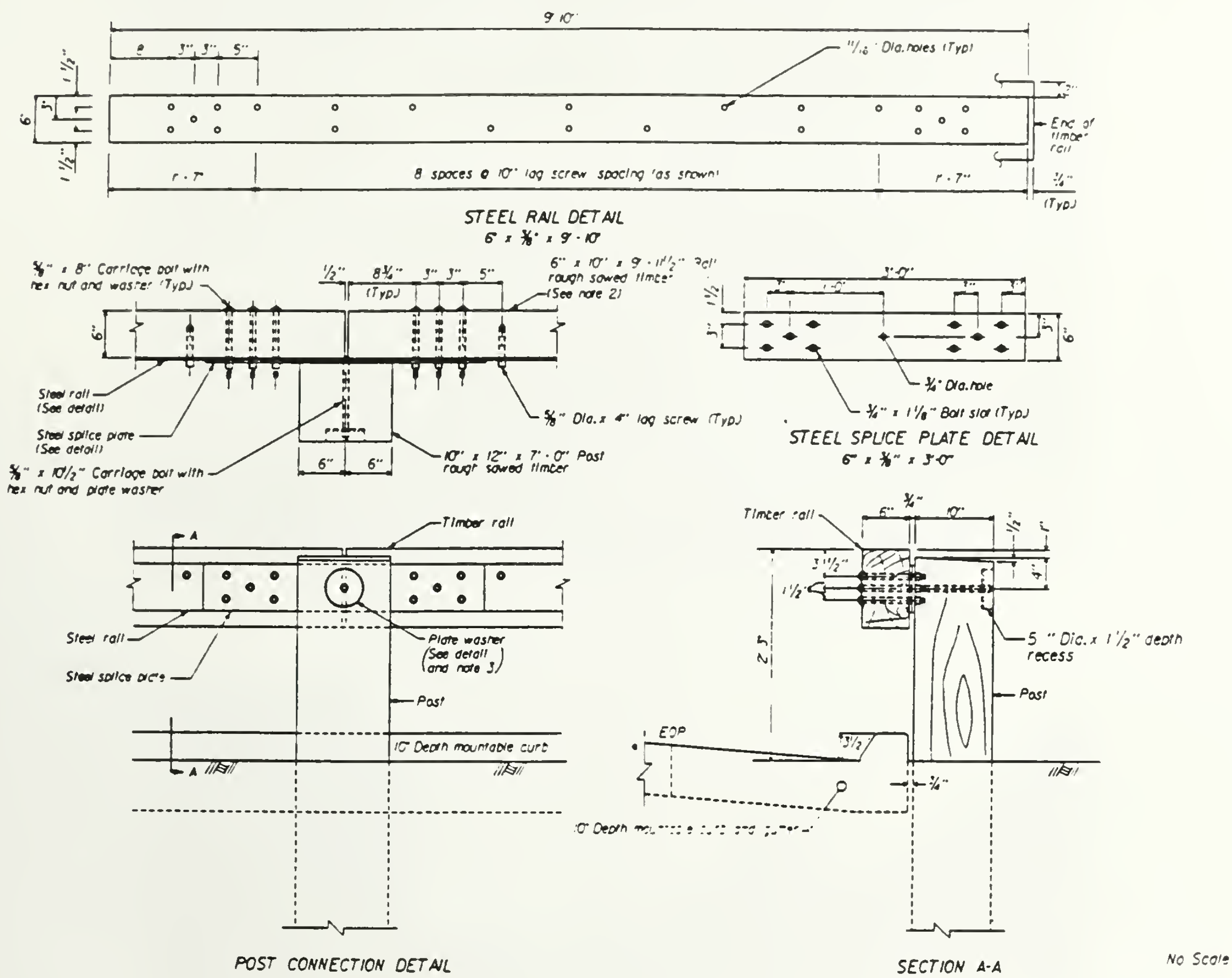


AASHTO Designation: G9

Post Type	W6 × 8.5 steel or 6" × 8" wood
Post Spacing	6' 3"
Beam Type	12 gauge Thrie-Beam
Nominal Barrier Height	32"–35"
Maximum Dynamic Deflection	approximately 2'

Standard Steel Guard Rail With Steel Posts

Steel Backed Timber Guard Rail with Wood Posts



AASHTO Designation: None

Post Type	10″ × 12″ wood
Post Spacing	
Beam Type	6″ × 10″ wood with steel plate backing
Nominal Barrier Height	27″
Maximum Dynamic Deflection	

Steel Backed Timber Guard Rail with Wood Posts

Standard Steel Rail with Wood Posts

Pressure treated wooden posts are driven into the ground for this type of guard rail. A standard steel rail is bolted to the post This type of rail is common on Massachusetts Highway Department maintained roadways.

Standard Steel Guard Rail with Wood Posts

Standard Steel Guard Rail with Wood Posts

Weathering Steel Guard Rail with Wood Posts

This system is currently in place in New York State. It consists of steel rails and wood posts similar to standard guard rail components, however the steel is treated to appear a dark brown color. The

surface is responsive to oxidation, which causes the brown matte color with time. This system behaves well after impact, as the surface of the steel will naturally return to a brown color if the surface coating has been chipped. It can be considered an unobtrusive safety improvement. The entire arrangement blends into its natural surroundings.

Weathering Steel Guard Rail with Wood Posts

Precast Simulated Stone Guard Walls

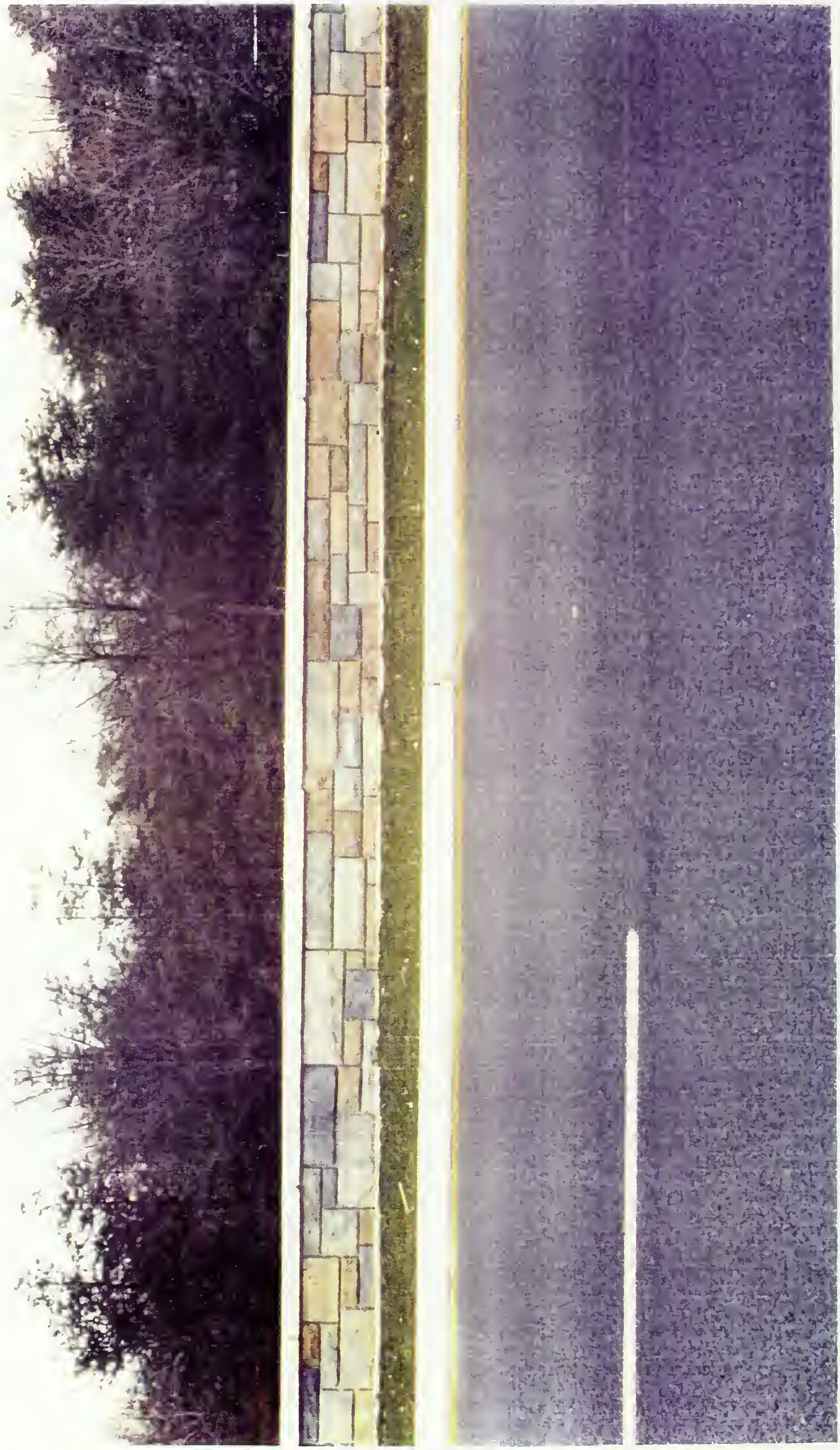
This style wall is very rustic in appearance. It has finished look of multicolor stones, placed irregularly. This result is accomplished at a precast manufacturing facility, by adding color enhancers and textures to the concrete mix and forms. The guard wall units contain steel reinforcing, which allows them to be fairly thin. Precast guardwall units are shipped to the site, where they are installed using a minimum of equipment. Backfill is placed and then compacted. The wall units are placed on cast-in-place foundations.

Stone Masonry Guard Walls

This style guard wall is similar in appearance to the cemented stone masonry retaining wall. It is approximately two feet thick because of the use of unreinforced natural stone. Fieldstones, held together with mortar, are stacked to the desired height, then the wall is capped with a flat piece of stone, typically granite or concrete. The guard wall sits on an unreinforced concrete foundation pad. Backfill is subsequently placed and compacted. Similar to the cemented stone masonry, the care required in the placement of the stones and the involvement of cast-in-place foundations causes this type of guard wall to be expensive. It easily creates the desired image, one of untouched nature, yet its solidity promotes a feeling of safety for the driver.

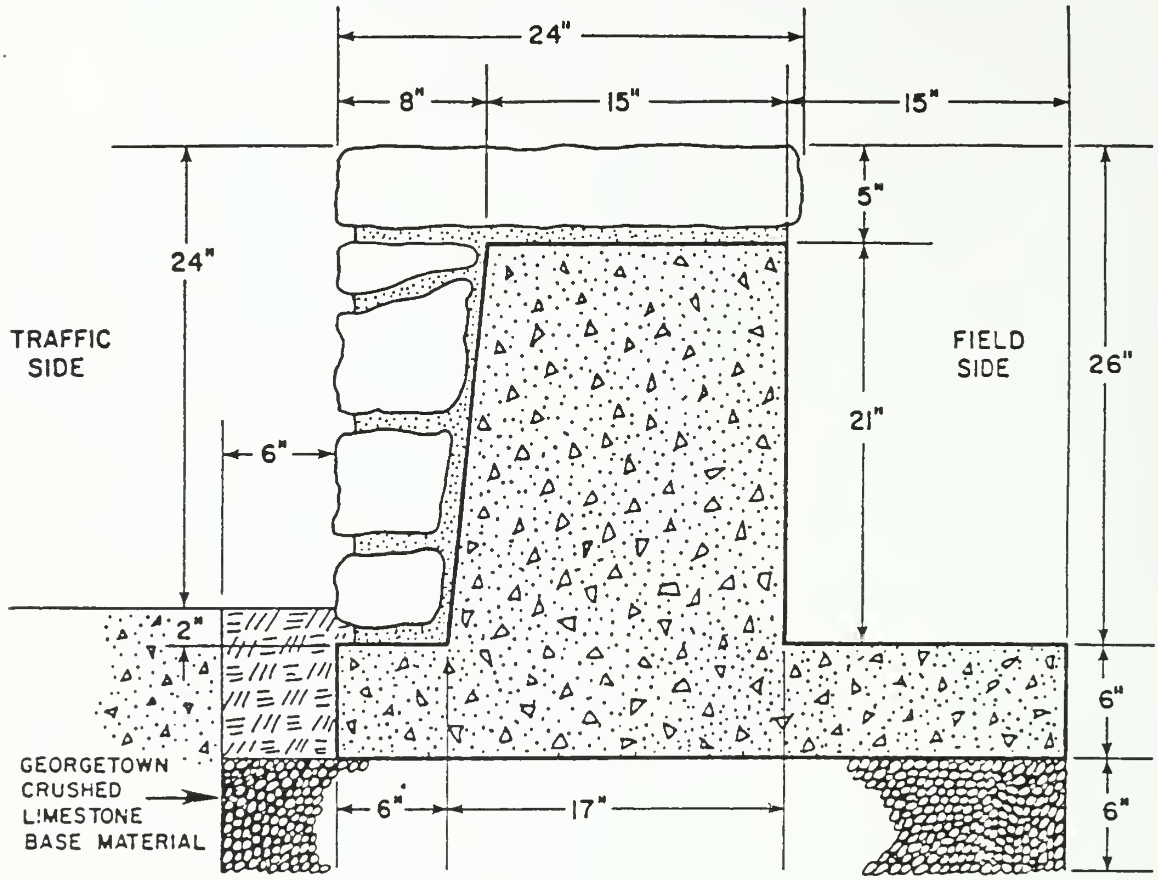
Committee Preference

Upon review of the alternatives presented by Vanesse Hangen Brustlin, Inc., the Jacob's Ladder Trail Scenic Byway Advisory Committee formally rated and ranked, in order of preference, the top three guard rail or wall alternatives to be used in the future replacement of existing sections of guard rail along the corridor. These choices, from first choice to third choice, were stone masonry (first), steel backed timber (second) and precast simulated stone and weathering steel (tied for third).



Precast Simulated Stone Guardwall

Stone Masonry Guardwall



Stone Masonry Guardwall

Construction Estimates and Design Parameters

Construction methods for the guard rails, regardless of the type, are similar. Posts are driven 3'-9" into the ground in suitable material, other methods may be necessary depending on the soil type or ledge material encountered. The rail is attached to posts with bolts.

Guard walls are constructed using methods comparable to those for retaining walls. Some site preparation is necessary, precast units are delivered and installed, with the necessary backfilling compacted in place. The stone masonry guardwall is built over a cast-in-place foundation, the stones are placed individually and a granite cap added last.

Design procedures for guard rails are similar to those described for retaining walls. Documents will include drawings, specifications and quantity estimates for the selected guard rail type. Anticipated design costs, based on 1,000 linear feet of guard rail are approximately $4,000 - $5,000.

The construction costs of the proposed guard rail and guard wall options vary considerably. The following table summarizes this cost.

Table 5. Approximate Cost per Linear Foot for Replacement Guard Rails and Guard Walls.

Guard Rail or Wall Type	Cost Per Linear Foot (Based on 1,000 lf construction)
Standard Steel Guard Rail with Steel Posts	$ 13.00
Steel Backed Timber Guard Rail with Wood Posts	$ 40.00
Standard Steel Guard Rail with Wood Posts	$ 13.00
Weathering Steel Guard Rail with Wood Posts	$ 14.00
Precast Simulated Stone Guard Walls	$ 70.00
Stone Masonry Guard Walls	$ 75.00

Source: Weighted Average Bid Prices Statewide and by Districts from Highway and Bridge Projects, MHD 1993.

Maple Street Bridge

The Pioneer Valley Planning Commission contracted with consulting engineers Holden Engineering and Surveying, Inc. (Holden) to provide an assessment including preliminary plans and cost estimates for the restoration of the Maple Street Bridge in Chester, Massachusetts. The Maple Street Bridge is adjacent to Route 20 and formerly connected Maple Street and Route 20 across the West Branch of the Westfield River. The bridge has been closed for a number of years.

Built in 1900, it is a riveted steel 8-panel Pratt through truss bridge with one span of 116 feet and a total length of 122 feet. The bridge is approximately 25 feet in width. Limited alteration and reinforcement occurred in 1928. Specifically, the intention is to rehabilitate and restore the bridge for use as a pedestrian and bicycle bridge including aesthetic planters, with potential for one-way vehicular access to serve the village business district.

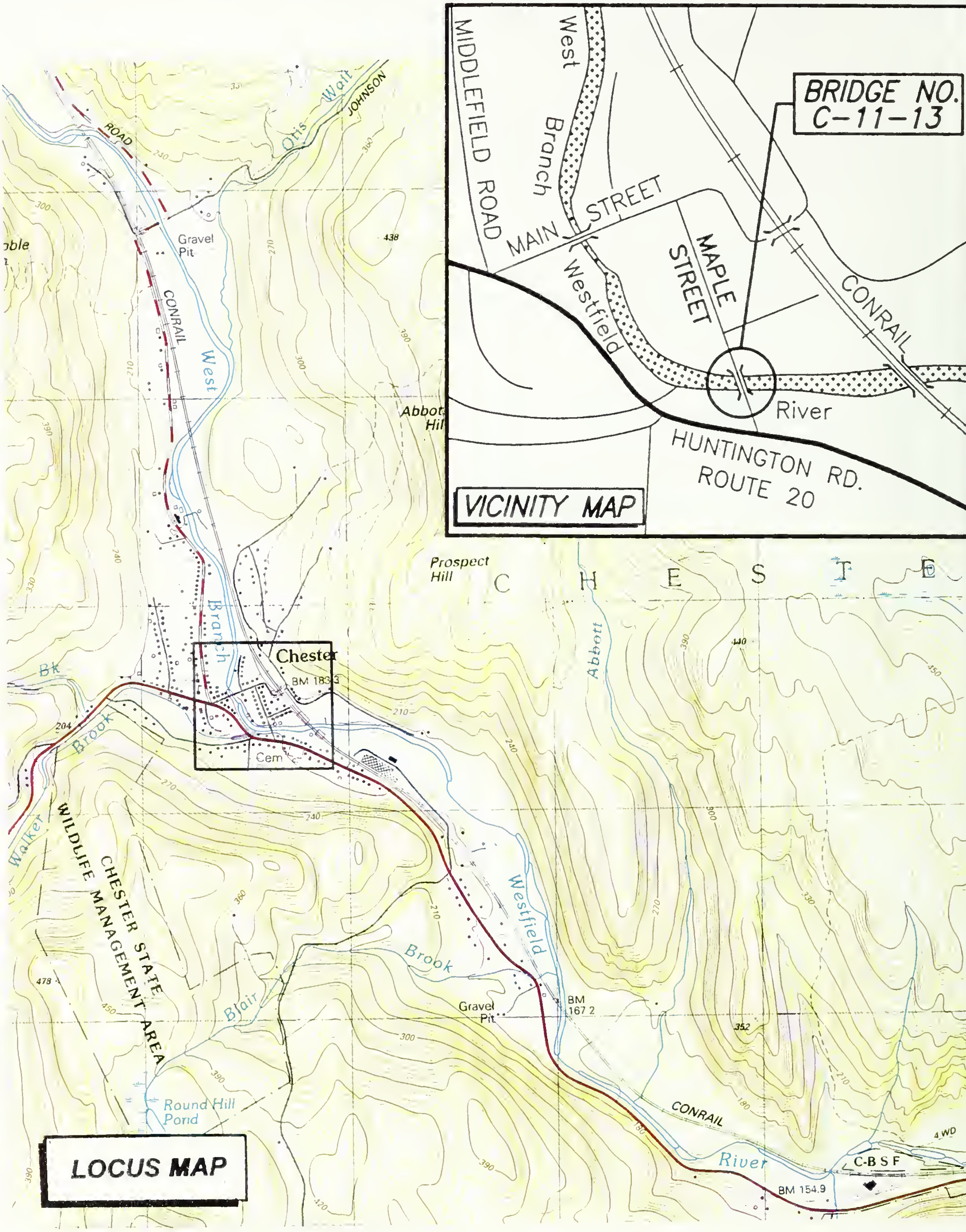
Holden conducted a detailed engineering investigation which included the in-depth, member-by-member inspection of the steel truss structure elements, bearings, and abutments; a structural load rating analysis of the existing through truss; a rehabilitation analysis to evaluate repairs required to ensure structural integrity of the existing bridge for pedestrian/bicycle and vehicular loading; evaluation of seven bridge rehabilitation schemes; estimated preliminary construction costs for seven bridge type alternatives and discussion of the Jacob's Ladder Trail Advisory Committee's selected alternative.

Description of Existing Bridge

The steel through truss was originally constructed in 1900 and has been rehabilitated over the years. Major rehabilitation was performed in 1928, including placement of eight inch stringers, four inch timber bridge deck, two inch timber sidewalk deck, truss strengthening straps, and new lattice railing. According to a local resident, steel purlins and steel grid deck were added in early 1970s. According to Massachusetts Department of Public works inspection report, the bridge was closed to all vehicular traffic (but open to pedestrians) in 1981 and closed to pedestrians a few years later. Primary truss elements consist of built-up members made up of steel plates, channels, and angles, connected with hot driven rivets. The bridge at one time carried a sixteen foot wide roadway (one lane) and a five foot sidewalk along the east fascia. The deck system currently consists of an open steel grid deck supported on six inch purlins and eight inch stringers. Transverse floor beams are fifteen inch I-Beams. Timber sidewalk decking and pedestrian railing are supported on steel stringers (channel and I-Beam) and a cantilevered floor beam bracket. The roadway vertical clearance is approximately sixteen feet (to upper truss portal). Bridge railing is bolted to each truss vertical and diagonals, with pedestrian handrail (assumed original) attached to the cantilevered floor beam brackets. The abutments consist of laid stone block with mortared joints. At the south abutment, stone masonry retaining walls have been constructed along the river to retain residential frontage.

Condition of Existing Bridge

Inspection of each structural steel element of the bridge was planned in detail prior to field inspection. Detailed inspection records were developed for all structural steel elements including upper chords, lower chords, end post diagonals, verticals, diagonals, horizontal braces, bottom lateral bracing, top laterals and struts, portal struts, floor beams, sidewalk brackets, roadway stringers, and sidewalk stringers. The compilation of over two hundred individual inspection records were used to record the observed physical conditions of the truss, and aid in determining truss rehabilitation requirements.



Maple Street Bridge - Engineering Study

Inspection of all primary and secondary steel truss members involved both visual and hands-on methods of evaluation including conventional measurement techniques to determine corrosion losses of steel sections. Inspection of bearings involved cleaning of bearing area to remove built-up debris on and around bearing devices. Close attention was given to signs of distress in main pins, bent anchor bolts, packed rust, and loss of bearing area under masonry plates. Inspection of abutment elements used both visual and hands-on methods for evaluation of masonry quality, which included identification of deteriorated material by the sounding method, removal of selected areas of deteriorated masonry with a chipping hammer, and measurement of other areas requiring repair.

This report does not provide detailed technical information pertaining to the bridge engineering study. The complete assessment including structural analysis, load rating capabilities and inspection records can be found in "Detailed Inspection Records for Maple Street Bridge No. C-11-13, Chester, Massachusetts by Holden Engineering and Surveying, Inc., 1994" and "Engineering Study for Maple Street Bridge Rehabilitation, Chester, Massachusetts; prepared for Pioneer Valley Planning Commission by Holden Engineering and Surveying, Inc., November 1994." These reports are on file and available for review at the Massachusetts Highway Department and the Pioneer Valley Planning Commission.

Required Rehabilitation

Holden Engineering conducted intensive field analysis of the structural condition of the Maple Street Bridge. This analysis, in concert with engineering assessments relating to load bearing and structural capacity, resulted in the identification of a number of key elements requiring replacement or repair. This included:

Replace existing bridge floor system including:

- bridge deck and railing;
- bidewalk deck and railing;
- floor beams and sidewalk brackets;
- bridge and sidewalk stringers.

Replace section of top plates of endpost diagonals.

Repair deteriorated lower limits of all east truss diagonals and verticals.

Repair west truss verticals at mid connection.

Replace all lower chord elements at east and west truss.

Replace all bottom laterals.

Replace all top (sway) struts.

Paint existing steel members designated to remain.

Repair bent vertical L101U101.

Replace expansion and fixed truss bearings.

Reconstruct abutment backwall, seat, and pedestals.

Point masonry abutment stems.

Bridge Rehabilitation Alternatives

Seven bridge rehabilitation alternatives were developed including four pedestrian and three vehicular bridge types. The primary loading variables, other than the pedestrian/vehicular live load, were the addition or omission of (architectural) planters and cantilevered pedestrian sidewalk. These alternatives are summarized below:

Pedestrian Bridges

Alternative 1A - Pedestrian bridge (retain existing sidewalk - no planters).

Alternative 1B - Pedestrian bridge (retain existing sidewalk - add planters).

Alternative 2A - Pedestrian bridge (remove existing sidewalk - no planters).

Alternative 2B - Pedestrian bridge (remove existing sidewalk - add planters).

Vehicular Bridges

Alternative 3A - Vehicular bridge (retain existing sidewalk).

Alternative 3B - Vehicular bridge (remove existing sidewalk).

Alternative 4 - Vehicular bridge (new truss bridge with existing truss facade).

A brief synopsis of each alternative, including proposed use, historical integrity, structure requirements and probable construction cost were developed for each alternative. Detailed information is available in the "*Engineering Study for Maple Street Bridge Rehabilitation*" report.

TRUSS ELEVATION
LOOKING EAST
PICTURE NO. 1A

TRUSS ELEVATION
LOOKING NORTH
PICTURE NO. 1C

TRUSS ELEVATION
LOOKING WEST
PICTURE NO. 1B

TRUSS ELEVATION
LOOKING SOUTH
PICTURE NO. 1D

Load Rating Analysis

As noted previously, the primary loading variables, other than the pedestrian/vehicular live load, were the addition or omission of (architectural) planters and cantilevered pedestrian sidewalk. The most significant observations pertaining to load include the following:

- For alternatives that include planters (Alternatives 1B and 2B) the weight of the planters alone is nearly two-thirds of total dead weight.
- The timber deck system for both pedestrian and vehicular bridge alternatives is heavier than truss weight, with the weight of deck system two times that of truss for vehicular bridge alternatives.
- The dead weight of the sidewalk is approximately the same weight as the truss.
- The dead weight of alternatives that include planters are three times greater than comparable alternatives without planters.

The varying weights of studied alternatives, as well as liveload category (pedestrian or vehicular), resulted in varying levels of rehabilitative needs to the existing truss. For alternatives that include planters (Alternatives 1B and 2B), there are significantly more truss members that require strengthening. The operating vehicular load capacity for pedestrian bridge alternatives are generally over H-20. Only Alternatives 3B, and 4 do not require any truss strengthening.

Alternative 1A - Pedestrian Bridge (Retain Existing Sidewalk - No Planters)

This bridge alternative would carry pedestrian and bicycle traffic, and could facilitate temporary maintenance and emergency vehicles at an infrequent level. Historically, the overall truss geometry would be retained, including the retainage of the cantilevered sidewalk, and restoration of wrought iron handrail (assumed original). Structurally, the following primary systems require replacement, due primarily to deterioration:

- entire lower chord system for east and west trusses, including panel point connections;
- entire floor system, including floor beams, stringers, and deck.

In addition, the following primary truss elements require strengthening to facilitate design loading:

- all endpost diagonals (four total);
- top chord elements (eight total);
- diagonals (four total).

Less strengthening would be required if a ten foot (minimum) pedestrian and bicycle travel way was used. An order of magnitude cost analysis was prepared for this alternative and estimated at $390,000.

MAPLE STREET
NORTH APPROACH
PICTURE NO. 2A

MAPLE STREET
SOUTH APPROACH
PICTURE NO. 2B

ROUTE 20
SOUTH APPROACH
LOOKING EAST
PICTURE NO. 2C

ROUTE 20
SOUTH APPROACH
LOOKING WEST
PICTURE NO. 2D

Alternative 1B - Pedestrian Bridge
(Retain Existing Sidewalk - Add Planters)

This bridge alternative would carry pedestrian and bicycle traffic, and could facilitate temporary maintenance and emergency vehicles at an infrequent level. Historically, the overall truss geometry would be retained, including the retainage of the cantilevered sidewalk, and restoration of wrought iron handrail.

Structurally, the following primary systems require replacement, due primarily to deterioration:

- entire lower chord system for east and west trusses, including panel point connections;
- entire floor system, including floor beams, stringers, and deck.

In addition, the following primary truss elements require strengthening to facilitate design loading:

- all endpost diagonals (four total);
- all top chord elements (twelve total);
- diagonals (eight total).

An order of magnitude cost analysis was prepared for this alternative and estimated at $410,000.

Alternative 2A - Pedestrian Bridge
(Remove Existing Sidewalk - No Planters)

This bridge alternative would carry pedestrian and bicycle traffic, and could facilitate temporary maintenance and emergency vehicles at an infrequent level. Historically, the overall truss geometry would be retained. However, the removal of the cantilevered sidewalk, and (assumed original) wrought iron handrail may not be historically advantageous.

Structurally, the following primary systems require replacement, due primarily to deterioration:

- entire lower chord system for east and west trusses, including panel point connections;
- entire floor system, including floor beams, stringers, and deck.

In addition, the following primary truss elements require strengthening to facilitate design loading:

- diagonals (four total).

Less strengthening would be required if a ten foot (minimum) pedestrian and bicycle travel way was used. An order of magnitude cost analysis was prepared for this alternative and estimated at $325,000.

Alternative 2B - Pedestrian Bridge (Remove Existing Sidewalk - Add Planters)

This bridge alternative would carry pedestrian and bicycle traffic, and could facilitate temporary maintenance and emergency vehicles at an infrequent level. Architectural planters (2'-0" high by 2'-6" wide) may be placed along each of the trusses. Historically, the overall truss geometry would be retained. However, the removal of the cantilevered sidewalk, and (assumed original) wrought iron handrail may not be historically advantageous.

Structurally, the following primary systems require replacement, due primarily to deterioration:

- entire lower chord system for east and west trusses, including panel point connections;
- entire floor system, including floor beams, stringers, and deck.

In addition, the following primary truss elements require strengthening to facilitate design loading:

- all Endpost Diagonals (four total);
- all Top Chord Elements (eight total);
- diagonals (four total).

An order of magnitude cost analysis was prepared for this alternative and estimated at $345,000.

GRID BRIDGE DECK
PICTURE NO. 3A

WEST TRUSS
ELEVATION
PICTURE NO. 3C

SIDEWALK
HANDRAIL
PICTURE NO. 3B

EAST TRUSS
ELEVATION
PICTURE NO. 3D

Alternative 3A - Vehicular Bridge (Retain Existing Sidewalk)

This bridge alternative would carry one lane of vehicular traffic and pedestrian traffic on an exterior sidewalk. Historically, the overall truss geometry would be retained, including the retainage of the cantilevered sidewalk, and restoration of wrought iron handrail (assumed original).

Structurally, the following primary systems require replacement, due primarily to deterioration:

- entire lower chord system for east and west trusses, including panel point connections;
- entire floor system, including floor beams, stringers, and deck.

In addition, the following primary truss elements require strengthening to facilitate design loading:

- diagonals (four total).

An order of magnitude cost analysis was prepared for this alternative and estimated at $385,000.

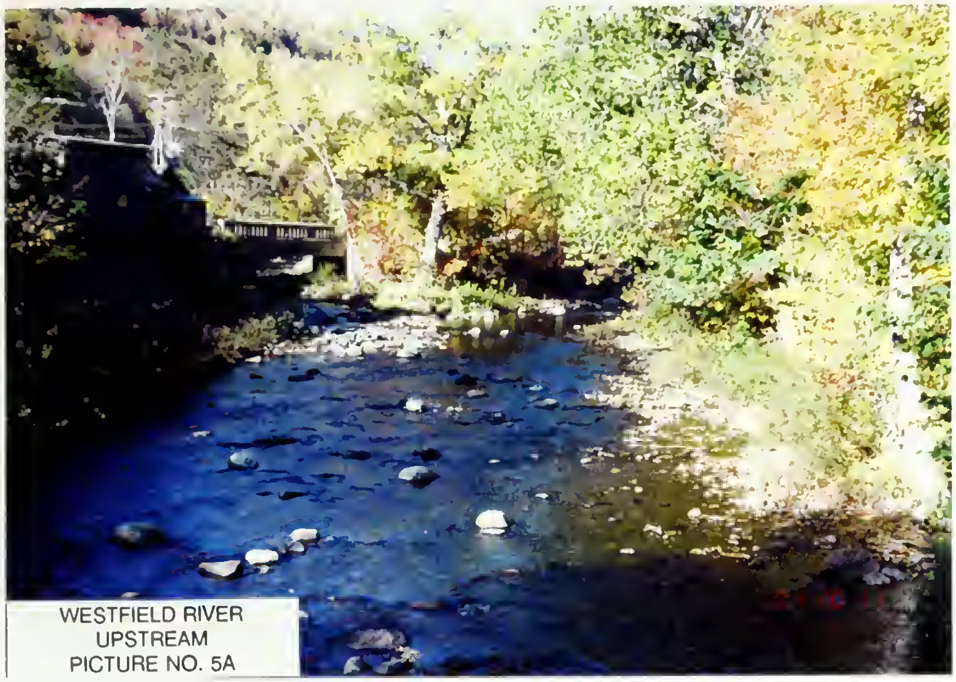
Alternative 3B - Vehicular Bridge (Remove Existing Sidewalk)

This bridge alternative would carry one lane of vehicular traffic and pedestrian traffic on an interior sidewalk. Historically, the overall truss geometry would be retained. However, the removal of the cantilevered sidewalk, and (assumed original) wrought iron handrail may not be historically advantageous.

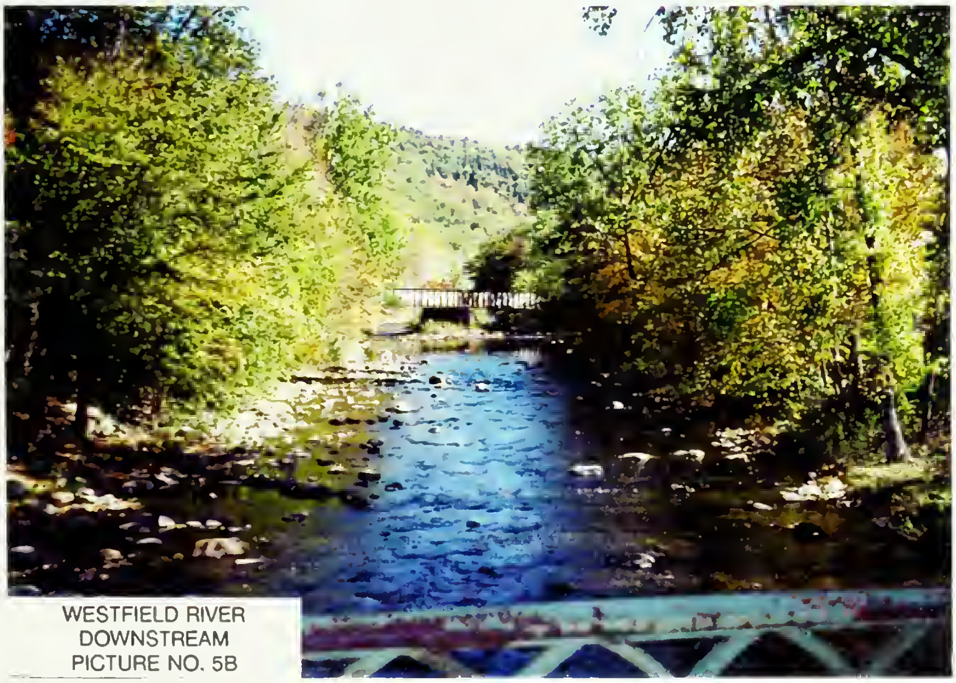
Structurally, the following primary systems require replacement, due primarily to deterioration:

- entire lower chord system for east and west trusses, including panel point connections;
- entire floor system, including floor beams, stringers, and deck.

No primary truss elements require strengthening to facilitate design loading. An order of magnitude cost analysis was prepared for this alternative and estimated at $335,000.

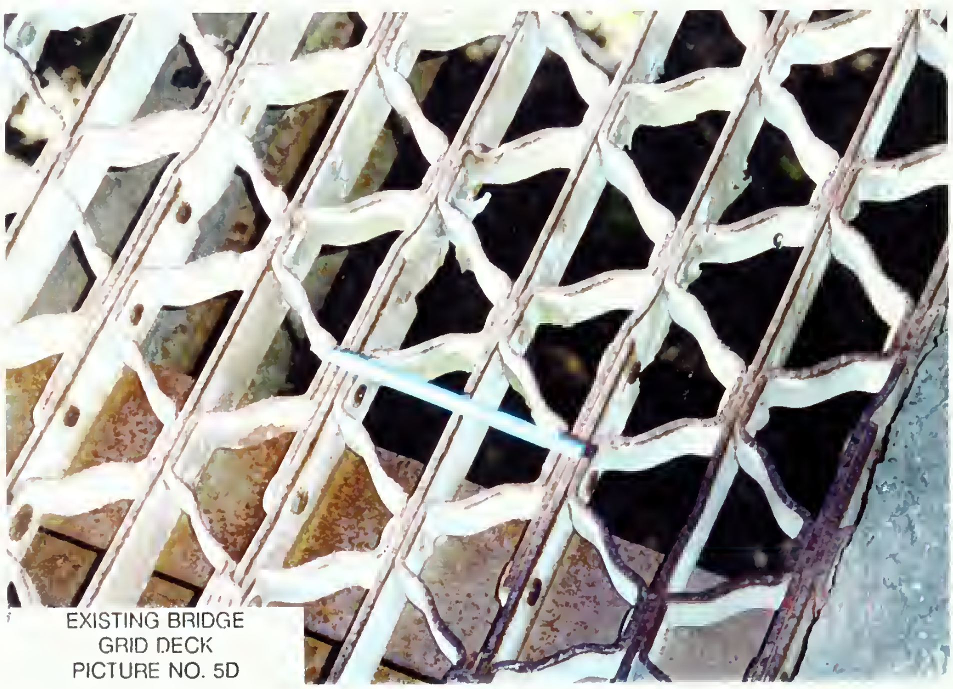


WESTFIELD RIVER
UPSTREAM
PICTURE NO. 5A



WESTFIELD RIVER
DOWNSTREAM
PICTURE NO. 5B

NORTH APPROACH
APPROACH RAIL
PICTURE NO. 5C



EXISTING BRIDGE
GRID DECK
PICTURE NO. 5D

Alternative 4- Vehicular Bridge
(New Truss Bridge With Existing Truss Facade)

This bridge alternative would carry one lane of vehicular traffic and pedestrian traffic on an exterior sidewalk. (supported by existing truss). Historically, the overall truss geometry would be retained, including the retainage of the cantilevered sidewalk, and restoration of wrought iron handrail (assumed original). The primary load carrying (prefabricated) truss may not be historically advantageous.

Structurally, the following primary systems require replacement, due primarily to deterioration:

- entire lower chord system for east and west trusses, including panel point connections;
- entire floor system, including floor beams, stringers to (provide bracing of exisisting truss).

No existing primary truss elements require strengthening. An order of magnitude cost analysis was prepared for this alternative and estimated at $470,000

Summary of Estimated Costs

Construction cost estimates for seven alternatives have been prepared based on 1994 costs. Recent Massachusetts Highway Department weighted average unit prices were used for estimating purposes wherever possible. MHD unit prices were also supplemented by other state agency unit prices. Estimates do not detail every item of construction, and show major items of work for the purpose of selecting a final bridge alternative. Table 6, "Maple Street Bridge Restoration Alternative Cost Summary," summarizes costs for the seven identified alternatives.

Primary rehabilitative work items common to most alternatives include the following:

- temporary shoring of structure and removal of deteriorated elements;
- reconstruct lower chords & panel point connections;
- reconstruct bridge floor system & cantilevered sidewalk;
- strengthen individual truss members;
- paint bridge.

Temporary Shoring of Structure & Removal of Deteriorated Elements

Before bridge element removal operations begin, it will be necessary to erect a temporary support system which is designed to carry all construction loading, and "remove" all loads from the existing truss. Since the lower chord has "failed," it will be imperative that the truss be shored before work to avoid potential overstressing of existing truss members. Once the bridge is adequately shored, removal of deteriorated elements may proceed. Deteriorated elements to be removed include Lower Chord and panel point connections, existing floor system (grid deck, purlins, stringers, floor beams, floor beam brackets), top struts, and any damaged member. The cost to temporarily shore the existing bridge and remove deteriorated steel elements was estimated to be nearly thirty percent of the total truss superstructure cost.

Reconstruct Lower Chords & Panel Point Connections

The current condition of all primary truss members above the deck and sidewalk was generally fair. However, elements below the deck line exhibited heavy deterioration and section loss. The lower chords were found in a "failed" condition or "imminent failure" condition, requiring replacement of all channels, plates, stay plates, and laces. In addition, the lower chord connection system, which consists of horizontal and vertical plates, also warrants replacement. Lower chord reconstruction includes localized stabilization of member, removal of deteriorated elements, and placement of new structural steel.

Reconstruct Bridge Floor system & Cantilevered Sidewalk

The current condition of the existing bridge deck, sidewalk, steel floor beams and stringers warrant the replacement of the entire floor system. An in-kind retrofit scheme was developed for the transverse floor beams and sidewalk bracket to match existing geometric conditions. By consensus, team

members concurred that a timber deck system would adequately meet historical, aesthetic, and structural requirements. Treated laminated timber transverse deck panels were selected as deck type, requiring longitudinal stringer spacing of four feet. The thickness of the timber deck and size of stringers depend on design loading, with vehicular liveload requiring a thicker panel than pedestrian liveload. Fabricators of deck panels (and timber railing) were consulted for thicknesses and costs. Four foot stringer spacing reduces the number of roadway stringers from eight stringers per bay to five. It is recommended that existing vehicular bridge rail be replaced, based on its current deteriorated condition, and because it does not meet currently acceptable standards. It is also recommended that the wrought iron pedestrian handrail be retained due to its historical value.

Strengthen Individual Truss Members

Based on structural load rating analysis, various truss members require strengthening to maintain a load level consistent with desired overall bridge load capacity. Proposed strengthening includes (localized) shoring of member (if required), removal of existing rivets, and placement of new structural steel and bolts. Strengthening may also involve total removal of the member and subsequent in-kind replacement.

Paint Bridge

Current practice for painting of an existing steel bridge structure includes the following major items:

- containment and environmental protection;
- surface preparation;
- structural painting (field applied).

During all cleaning and painting operations, the West Branch Westfield River and surrounding properties are specified to be protected from any debris involved in the painting process, including rust, blasting residue, paint, etc. The cost to paint the existing and new bridge elements was estimated to be approximately twenty-five percent of the total truss superstructure reconstruction cost.

The cost to erect a prefabricated truss bridge (Alternative 4) was developed with information from three bridge fabricators/contractors. The cost of fabricating and erecting a new one lane bridge had the highest estimated construction cost, nearly thirty percent higher than other identified alternatives. Two-thirds of total cost for this alternative included temporary shoring and bridge removal, reconstructing lower chords and sidewalks, and painting. (Items that are typical to other alternatives.)

From a cost perspective, all identified rehabilitation alternatives (excluding Alternative 4) are comparable, being ten to fifteen percent within the average conceptual estimate of $365,000. The construction requirements, other than truss strengthening and new bridge floor system, do not vary greatly between alternatives.

Table 6. Maple Street Bridge Restoration Alternative Cost Summary.

	Alternative Number						
Major Work Item	1A	1B	2A	2B	3A	3B	4
Temporary Shoring of Structure	$65,000	$65,000	$65,000	$65,000	$65,000	$65,000	$65,000
Removal of Deteriorated Elements	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000
Reconstruct Lower Chords & Panel Point Connections	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000
Reconstruct Bridge Floor System	$85,000	$85,000	$85,000	$85,000	$100,000	$100,000	———
Reconstruct Cantilevered Sidewalk	$30,000	$30,000	———	———	$30,000	———	$30,000
Strengthen Truss	$30,000	$50,000	$10,000	$30,000	$10,000	$5,000	$5,000
Paint Bridge	$90,000	$90,000	$75,000	$75,000	$90,000	$75,000	$90,000
Rehabilitate Substructure	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$30,000
Construct Lower Chord Bracing	———	———	———	———	———	———	$25,000
Construct A New Bridge	———	———	———	———	———	———	$150,000
Total	**$390,000**	**$410,000**	**$325,000**	**$345,000**	**$385,000**	**$335,000**	**$470,000**

Conclusions and Recommendations

Numerous rehabilitation alternatives were identified and investigated by the project team, to either convert the existing truss to a pedestrian bridge or modifying the existing structure to carry vehicular traffic. An in-depth field inspection and a structural load rating analysis were conducted to identify the magnitude of necessary work to rehabilitate the existing truss structure to a minimum acceptable level. The condition of the existing floor system (bridge deck, stringers, and floor beams) warranted total replacement. Primary truss members were found generally in fair condition, except below the deck line, where lower chords, and truss web members were found significantly deteriorated. Results of the load rating analysis concluded that the truss member strengthening requirements varied greatly depending on the alternative.

Seven alternatives were identified by the project team for consideration. Design loading variables included pedestrian and vehicular live load, planters, and retainage/removal of existing sidewalk.

The probable (order of magnitude) construction cost to rehabilitate existing bridge for either pedestrian or vehicular live load was estimated between $325,000 to $410,000 for six truss strengthening alternatives and nearly $500,000 for a "new" truss alternative. The probable cost to demolish the existing bridge (permanently remove bridge from system) was estimated at $40,000 - $50,000. The probable construction cost to construct a new two-lane bridge was estimated at $750,000 - $800,000.

Committee Preference

On November 9, 1994, the Jacob's Ladder Trail Advisory Committee met at Becket Town Hall to discuss the seven alternatives as presented by Holden Engineering.

Representatives from the Pioneer Valley Planning Commission, Berkshire County Regional Planning Commission, Massachusetts Highway Department District 1, residents and town officials from Chester and Holden Engineering & Surveying, Inc. were present. Key items that were discussed included:

- The desire to retain the existing cantilevered sidewalks was unanimous, due to its historical and aesthetic value. This eliminated alternatives 2A, 2B and 3B.
- There were mixed opinions on Alternative 4 (new truss bridge with existing truss facade).

Some liked this alternative, while others expressed the opinion that it would greatly detract from the historical significance of the bridge and would make roadway approaches less smooth. The committee concurred that if the need for an HS-20 loading capability arose in the future, the latitude to institute this alternative at that time was still there. Therefore, by consensus, this alternative was eliminated from further study.

- The discussion of whether or not this bridge should be rehabilitated to carry exclusively pedestrian/bicycle traffic or exclusively vehicular traffic was discussed. Key questions that arose during discussions included:
  - Is a one-lane (one-way) bridge acceptable from a traffic and safety point of view?
  - What minimum design truck loading would be required?

It was recommended that the concept of alternative 1B (pedestrian bridge with architectural planters and sidewalk) be implemented for initial construction, with modification of design to include future truck loading. This would give the town of Chester the option to "switch" the bridge to vehicular (if needed or desired) by removing planters, installing traffic rails (alternative 3A) and initiating additional safety improvements to the approaches. By consensus, the committee concurred that the hybrid alternative combining alternatives 1B (initial) and alternative 3A (potential future) be combined for further development in preliminary (sketch) plans.

The recommended alternative is provided as Figure 3. Preliminary construction cost estimates for this alternative totaled $488,508 including all required work items, engineering, mobilization and contingencies. A detailed breakdown is provided as Table 7.

Table 7. Preliminary Construction Cost Estimate for Preferred Restoration Alternative

Item Description	Quantity	Unit	Unit Cost	TotalItem Cost	Note
Clean and Paint Steel Bridge (29 Tons)	1	LS	$72,500	$72,500	(1)
Shoring and Jacking Superstructure	1	LS	$50,000	$50,000	—
Remove Existing Deteriorated Steel Elements	1	LS	$32,000	$32,000	(2)
Construct New Tension Diagonals	1	LS	$16,500	$16,500	(3)
Repair of Upper Chord & End Post Diagonals	1	LS	$33,000	$33,000	(4)
Construct New Top Struts	1	LS	$8,500	$8,500	(5)
Construct New Lower Chords	1	LS	$25,000	$25,000	(6)
Construct New Timber Deck and Railing	1	LS	$48,000	$48,000	(7)
Construct New Steel Floor System	1	LS	$40,000	$40,000	(8)
Construct New Sidewalk	1	LS	$23,000	$23,000	(9)
Miscellaneous Steel Truss Repairs	1	LS	$5,000	$5,000	—
Removal & Replacement of Truss Bearings	4	ES	$1,500	$6,000	—
Estimated Approach Work (Minimal)	1	LS	$5,000	$5,000	(10)
Abutment Repairs	1	LS	$20,000	$20,000	(11)
Subtotal				**$384,500**	

Subtotal:	$384,500
Contingencies:	$ 38,450
Mobilization:	$ 21,148
Construction Engineering:	$ 44,410
Total Estimated Cost:	**$488,508 (13)**

Notes:

(1) Bridge painting estimates based on $2,500 per ton of steel.

(2) Lower chords, sidewalk, grating, purlins, stringers & floor beams.

(3) Replace 12 diagonals; estimated weight = 4,100 lbs.

(4) Repair 16 members (new cover plates); estimated weight = 8,250 lbs.

(5) Replace 5 members; estimated weight = 1,880 lbs.

(6) Replace 16 members & panel point connections; estimated weight = 8,000 lbs.

(7) Includes treated timber deck panels & timber railing.

(8) Floor beams, stringers & bracing; estimated weight = 26,700 lbs.

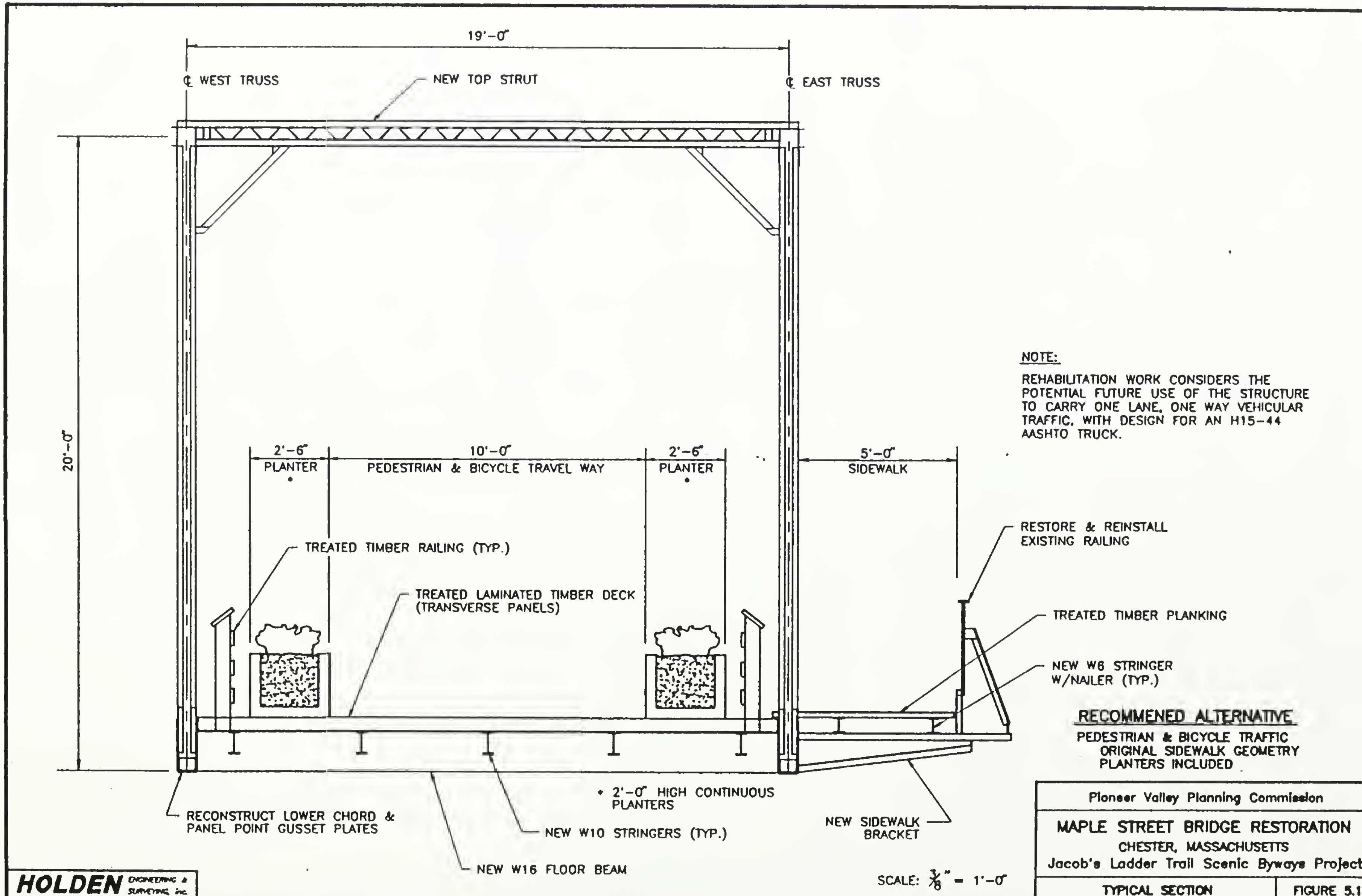
(9) Includes SW bracket, stringers timber deck & railing.

10) Minimal excavation and pavement work.

(11) Includes concrete seat, earthwork & masonry repair.

12) Cost of planters not included in this estimate.

(13) Estimated Maintenance Cost Per Year = $3,000/year (removal/resetting of planters,snow re moval, cleaning of timber deck & lower truss, timber retreatment & repair and painting (touch up).


19'-0"
℄ WEST TRUSS
NEW TOP STRUT
℄ EAST TRUSS
20'-0"
2'-6"
PLANTER
10'-0"
PEDESTRIAN & BICYCLE TRAVEL WAY
2'-6"
PLANTER
5'-0"
SIDEWALK
NOTE:
REHABILITATION WORK CONSIDERS THE POTENTIAL FUTURE USE OF THE STRUCTURE TO CARRY ONE LANE, ONE WAY VEHICULAR TRAFFIC, WITH DESIGN FOR AN H15-44 AASHTO TRUCK.
TREATED TIMBER RAILING (TYP.)
TREATED LAMINATED TIMBER DECK (TRANSVERSE PANELS)
RESTORE & REINSTALL EXISTING RAILING
TREATED TIMBER PLANKING
NEW W6 STRINGER W/NAILER (TYP.)
RECOMMENED ALTERNATIVE
PEDESTRIAN & BICYCLE TRAFFIC
ORIGINAL SIDEWALK GEOMETRY
PLANTERS INCLUDED
• 2'-0" HIGH CONTINUOUS PLANTERS
RECONSTRUCT LOWER CHORD & PANEL POINT GUSSET PLATES
NEW W10 STRINGERS (TYP.)
NEW W16 FLOOR BEAM
NEW SIDEWALK BRACKET
SCALE: 3/8" = 1'-0"
HOLDEN ENGINEERING & SURVEYING, inc.
Pioneer Valley Planning Commission
MAPLE STREET BRIDGE RESTORATION
CHESTER, MASSACHUSETTS
Jacob's Ladder Trail Scenic Byways Project
TYPICAL SECTION
FIGURE 5.1

Chester Jail

The Pioneer Valley Planning Commission contracted with the architectural firm of Margo Jones to develop outline specifications and operating cost estimates for the rehabilitation and renovation of the Chester Jail and Museum (Chester Jail, hereafter). The Chester Jail is a historically significant structure which is on Route 20 and contributes directly to interpretation of the byway. It is the intention to stabilize this structure and secure it for future use as a visitor's destination. A variety of repairs are needed, including foundation, plumbing, septic, site work and renovation to the front entrance to allow for accessibility.

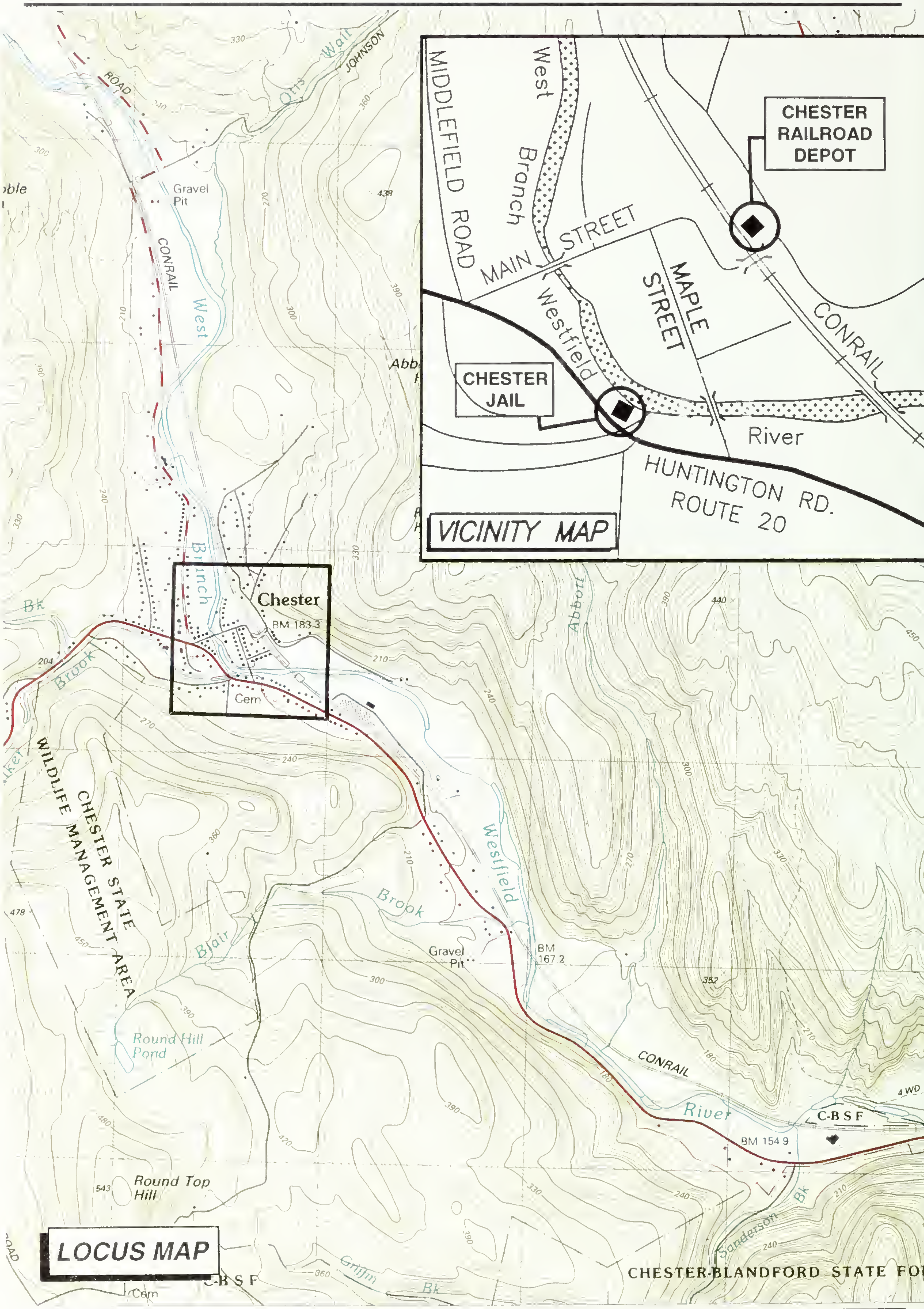
Assessment of Jail

The Chester Jail is in current need of minor refurbishment and repair in order to continue as an historic museum of local interest.

The jail is a one story brick masonry structure with full basement, built circa 1840. It was built to house unruly members of the railroad crew. It is located on a very small parcel of land bordering on the West Branch of the Westfield River. The building is tight to the lot line on the east and has approximately thirty feet of side yard to the west. The sidewalk is approximately twelve feet from the front door.

The building has no sanitary facilities due to a failed septic system. Due to severe environmental and physical constraints, a tight tank is the only alternative as a means of sanitary solid waste disposal. Regrading of the site will be required such that the soil is graded away from the building and swaled to the rear, rather than pitching toward the building as it does currently.

Repointing of the entire building is required with a number of minor repairs recommended as outlined in the preliminary specifications. Other minor repairs are also needed, such as replacing the rear basement door and repairing existing windows. All exterior trim needs painting. The existing toilet should be made operational, with new fixtures, lighting and wiring.


CHESTER
RAILROAD
DEPOT
MIDDLEFIELD ROAD
West
Branch
MAIN STREET
MAPLE
STREET
Westfield
CONRAIL
CHESTER
JAIL
River
HUNTINGTON RD.
ROUTE 20
VICINITY MAP
Chester
BM 183.3
Cem
CHESTER STATE
WILDLIFE MANAGEMENT AREA
Round Hill
Pond
Round Top
Hill
Gravel
Pit
CONRAIL
Westfield
Brook
Blair
River
BM 167.2
BM 154.9
C-B S F
Sanderson Bk
Griffin Bk
CHESTER-BLANDFORD STATE FOR
LOCUS MAP

The building needs to be made accessible, as much as is feasible, given its limited use and size. A concrete ramp is proposed to access the front entrance to the building. Other interior access improvements (toilet or lift), are not being proposed due to primary use by the public as an information and exhibit center, for brief visits during the summer months.

The estimated total cost of the rehabilitation is approximately $73,500. The estimated yearly operating and maintenance costs for the building as rehabilitated is approximately $3,000.

Outline of Work and Preliminary Budget Cost Estimate

General Conditions: $10,000

Site Work - Demolition: $ 6,550

Demolition

- Remove two concrete patches at lower level windows (rear & left elevations).
- Remove wood infill from Masonry opening at lower level (front right elevation).

Site Work

- Remove all overhanging tree limbs, so as none within 10' vertically of highest point of roof.
- Regrade left and rear sides of building so as to facilitate proper drainage.
- Install new tight tank septic system.

Concrete: $ 4,500

Construct handicapped ramp with iron pipe rails, to front door.

Masonry: $ 8,600

- Perform mortar analysis on old mortar to determine mix ratio and sand color.
- Reconstruct chimney from just below roof line (include copper flashing).
- Repoint most of entire building.
- Surface clean entire masonry portion of building.
- Remove non-conforming previously completed repointing.
- Regrout all joints at front door sill and steps.
- Caulk joint between brick and stone (left elevation).
- Repair bulging foundation wall (interior of left elevation, lower level).
- Stabilize and correct building settlement at left rear.
- Repair and replace cracked concrete blocks in foundation of wood framed portion of building.
- Patch foundation walls with brick at three locations where improper patches have been removed; tooth bricks into existing wall.

Carpentry:	$ 3,500

- Replace drip caps at windows in wood framed portion of building.
- Make all double hung windows operable.
- Remove existing flag pole and replace with new aluminum one.
- Replace rear door (including all hardware) with steel door and frame.
- Provide and install new toilet room accessories.

Roofing:	$ 1,800

- Evaluate existing membrane roof. Terminate correctly if practical, otherwise remove and replace with single-ply hypalon membrane roof.
- Replace roof slates (either missing or broken).

Painting:	$ 1,800

- Scrape, sand and paint all exterior trim, siding, doors and windows.
- Reputty all windows.
- Seal knots in wood siding.

Plumbing:	$ 3,250

- Install new fixtures in toilet room.
- Provide interior work associated with new septic system.

Septic System Replacement:	$ 8,500

- System design and approval.
- Remove existing system.
- Installation of tight tank system.

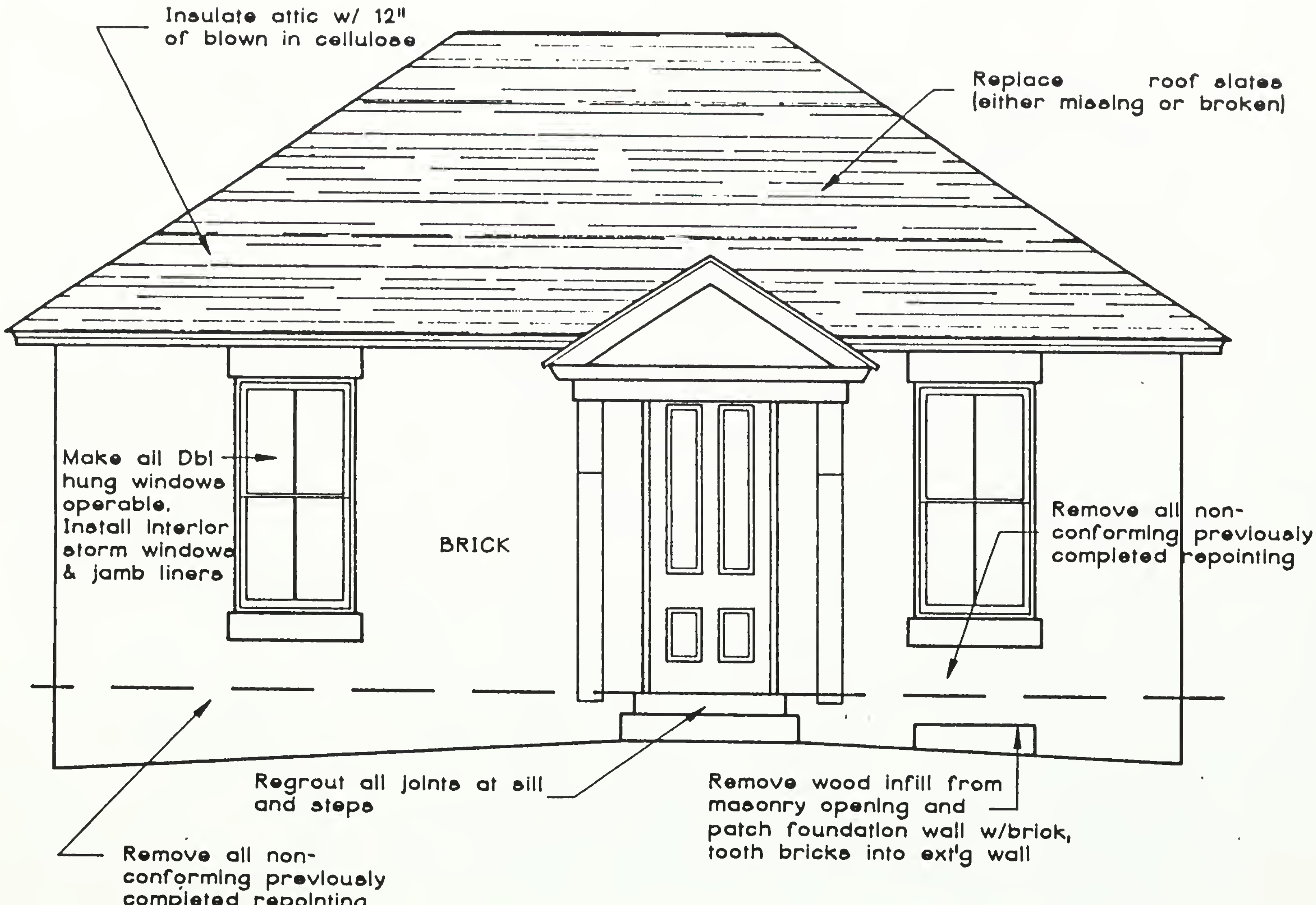
Electrical:	$ 1,500

- Relocate electrical service panel (temp) until masonry work completed.
- Rewire toilet room (new lighting, GFI circuit, etc.

Overhead & Profit:	$ 3,750
Bonds:	$ 750
Architectural Design & Oversight:	$ 9,000
Contingency:	$10,000
TOTAL	**$73,500**

Opinion of Probable Costs for Yearly Operating and Maintenance

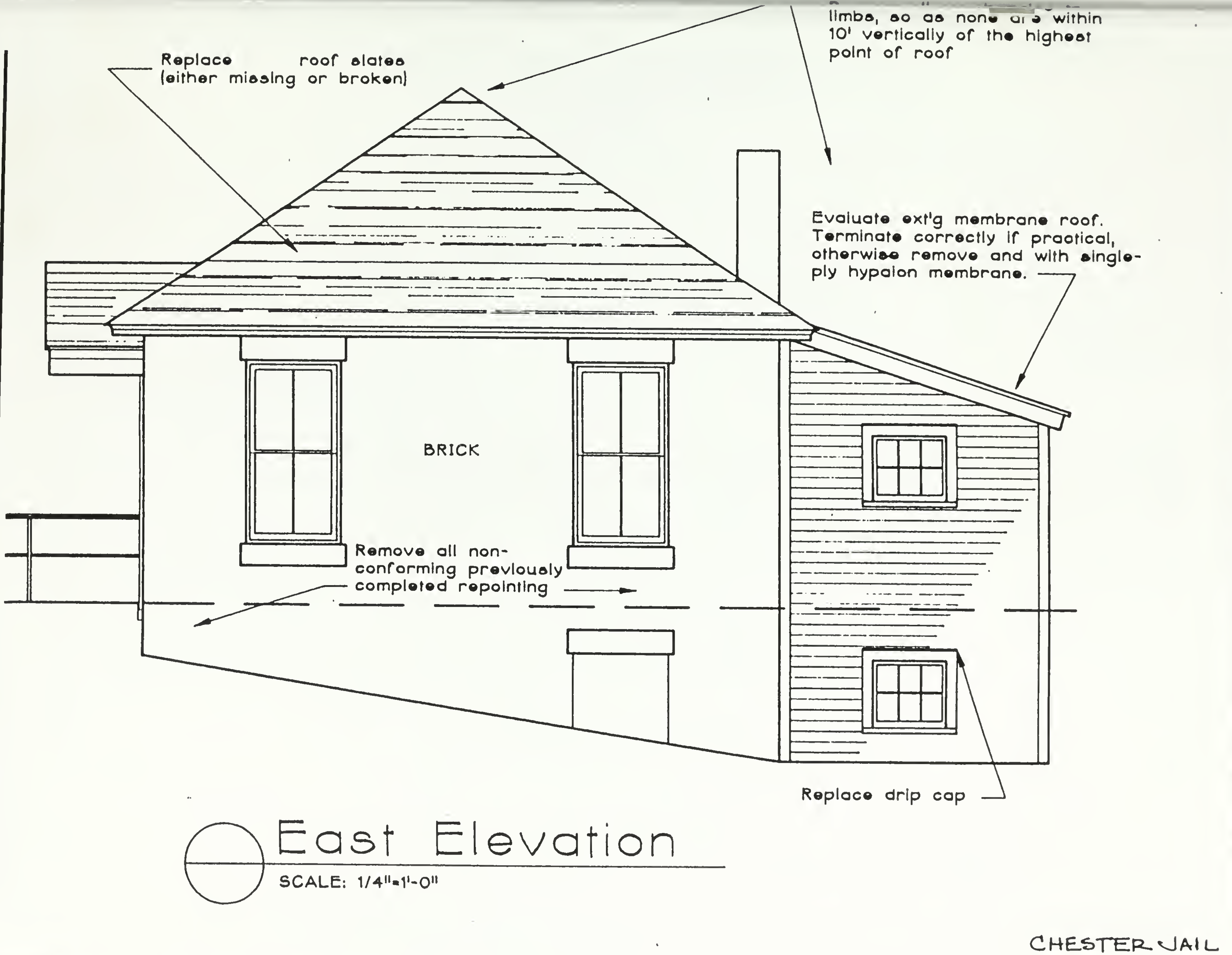
Heating: Recommend continuous heating during winter heating season.	$ 900
Electric: $25/month average	$ 300
Water: No meter currently in place, may vary slightly.	$ 100
Septic (Tight Tank) Pumping: Minimal pumping of 2X per year	$ 300
General Maintenance: Interior/exterior, based on 1,110 s.f. floor area	$ 750
Reserve Fund: 1% of budget estimate	$ 650
TOTAL	**$3,000**

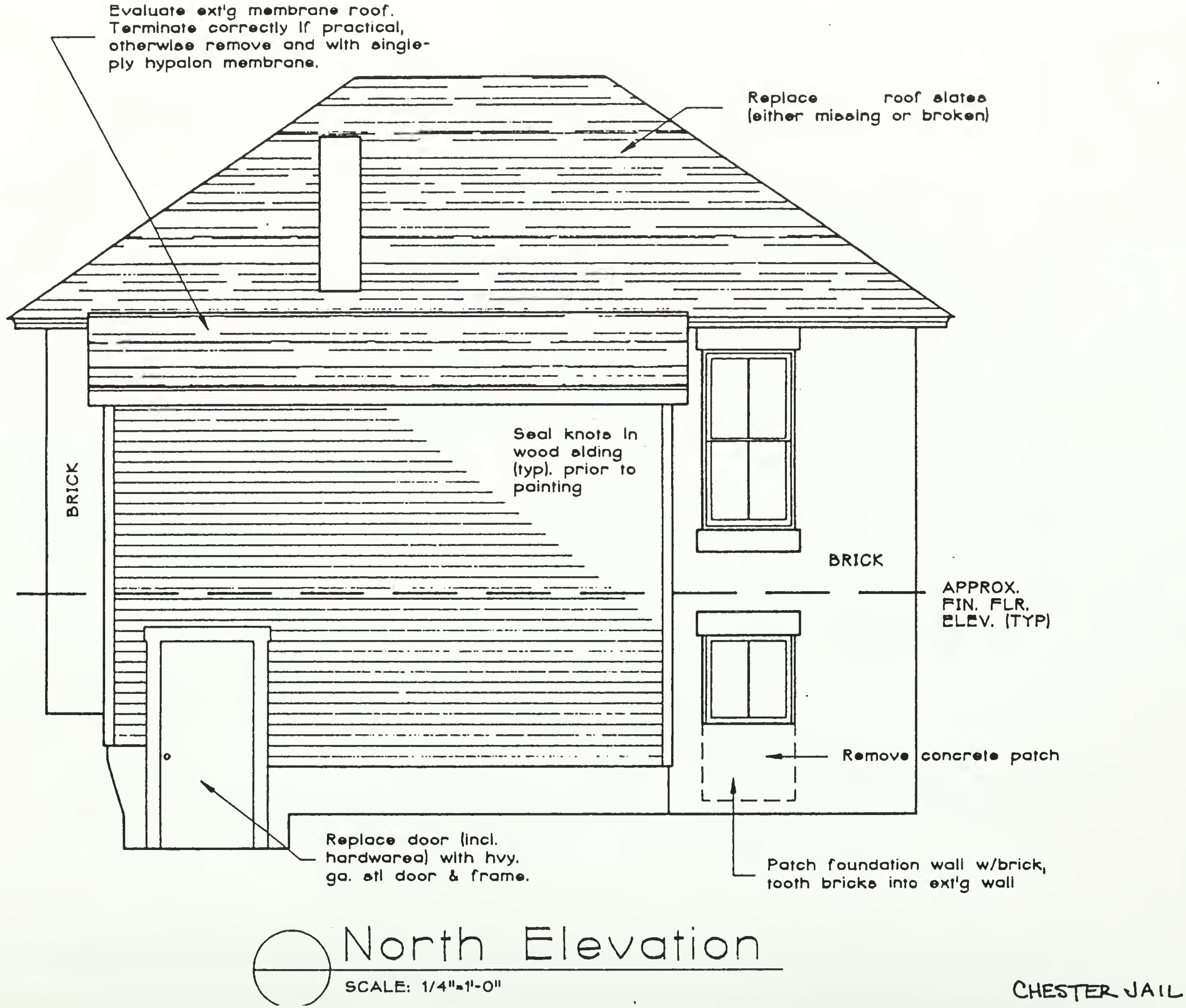


South Elevation

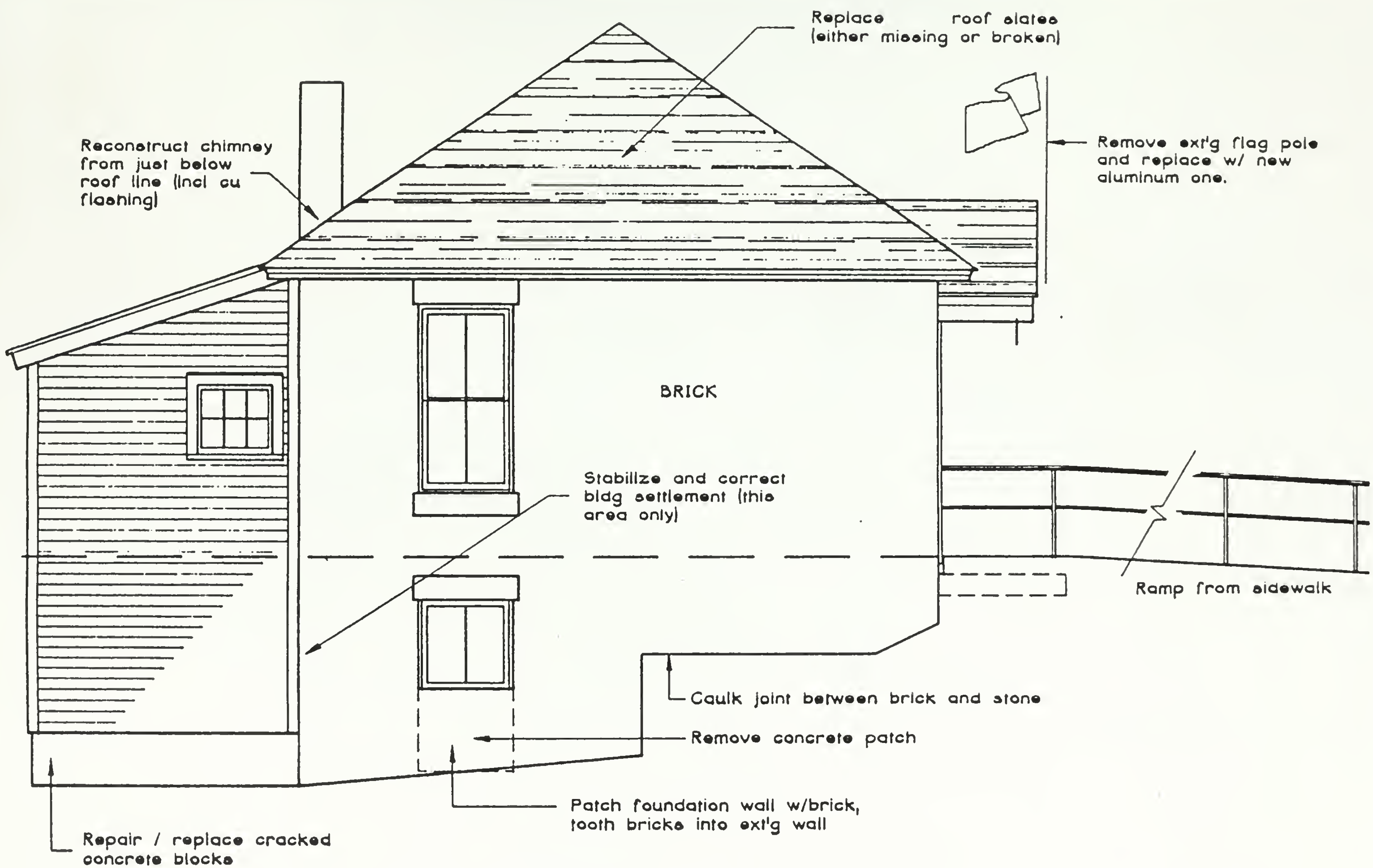
SCALE: 1/4"=1'-0"

CHESTER JAIL


limbs, so as none are within 10' vertically of the highest point of roof
Replace roof slates (either missing or broken)
Evaluate ext'g membrane roof. Terminate correctly if practical, otherwise remove and with single-ply hypalon membrane.
BRICK
Remove all non-conforming previously completed repointing
Replace drip cap
East Elevation
SCALE: 1/4"=1'-0"
CHESTER JAIL



Evaluate ext'g membrane roof. Terminate correctly if practical, otherwise remove and with single-ply hypalon membrane.
Replace roof slates (either missing or broken)
Seal knots in wood siding (typ). prior to painting
BRICK
BRICK
APPROX. FIN. FLR. ELEV. (TYP)
Remove concrete patch
Replace door (incl. hardwarea) with hvy. ga. stl door & frame.
Patch foundation wall w/brick, tooth bricks into ext'g wall
North Elevation
SCALE: 1/4"=1'-0"
CHESTER JAIL

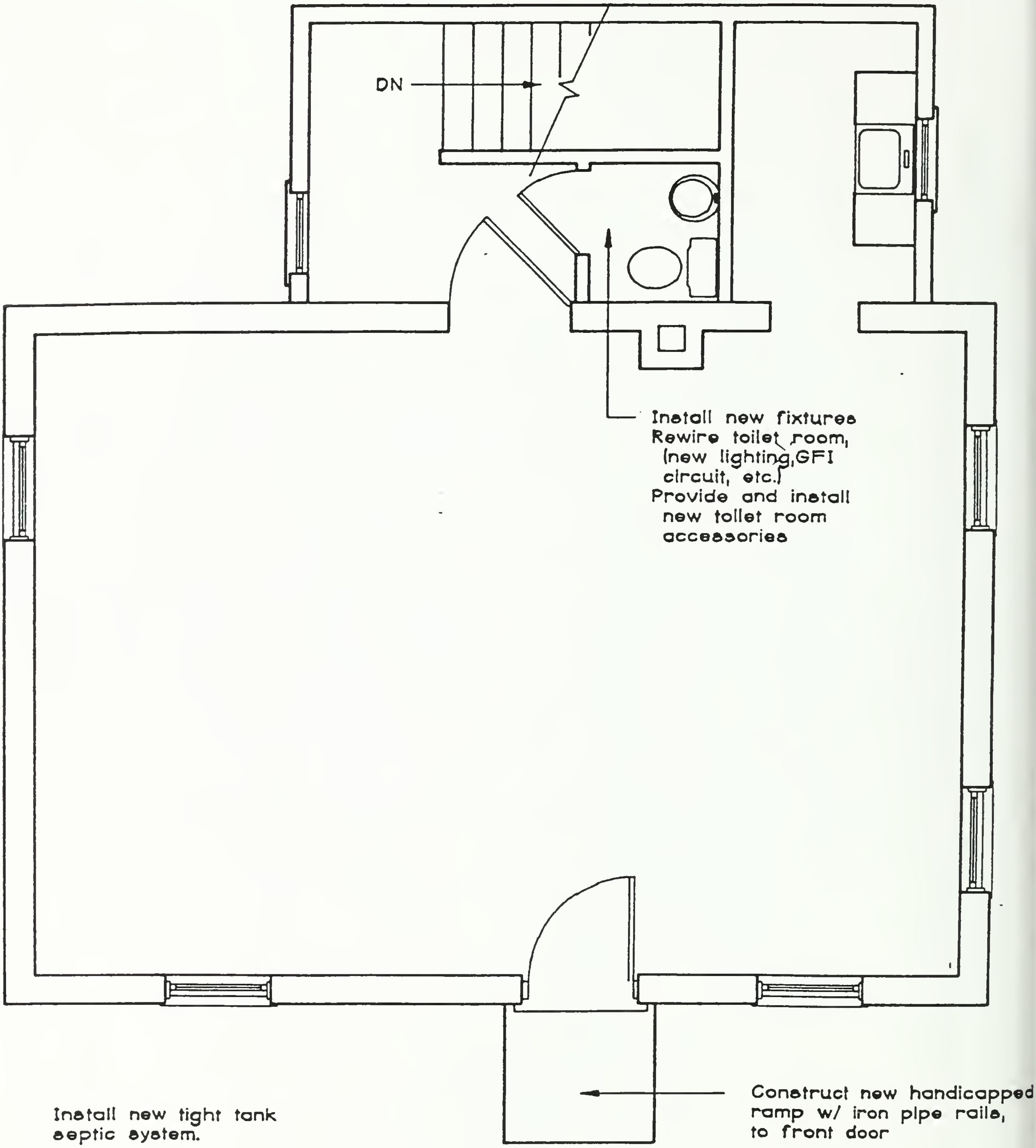


West Elevation

SCALE: 1/4"=1'-0"

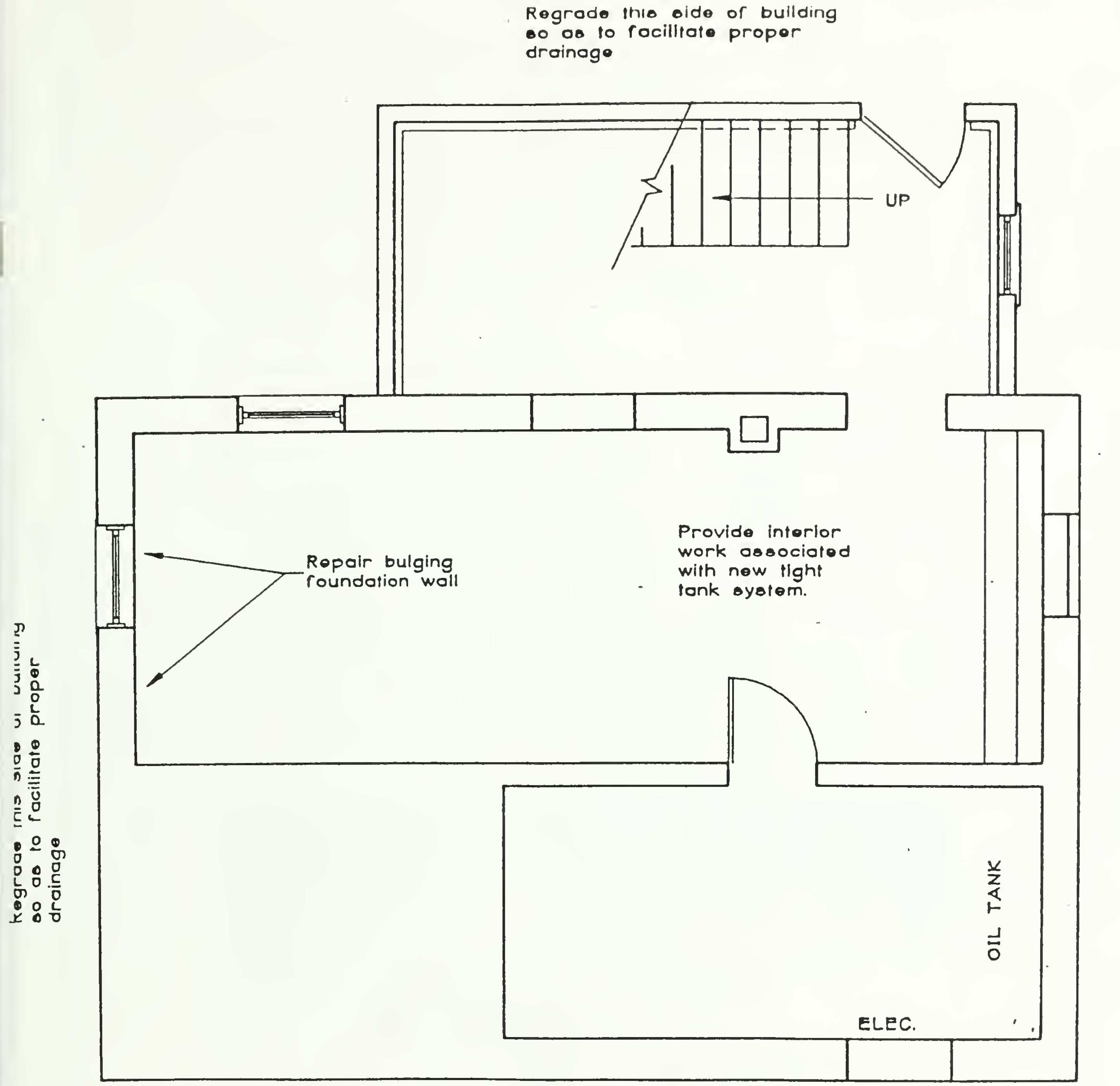
CHESTER JAIL

CHESTER JAIL



First Floor Plan

SCALE: 1/4"=1'-0"



Ground Floor Plan

SCALE: 1/4"=1'-0"

CHESTER JAIL

GENERAL NOTES:

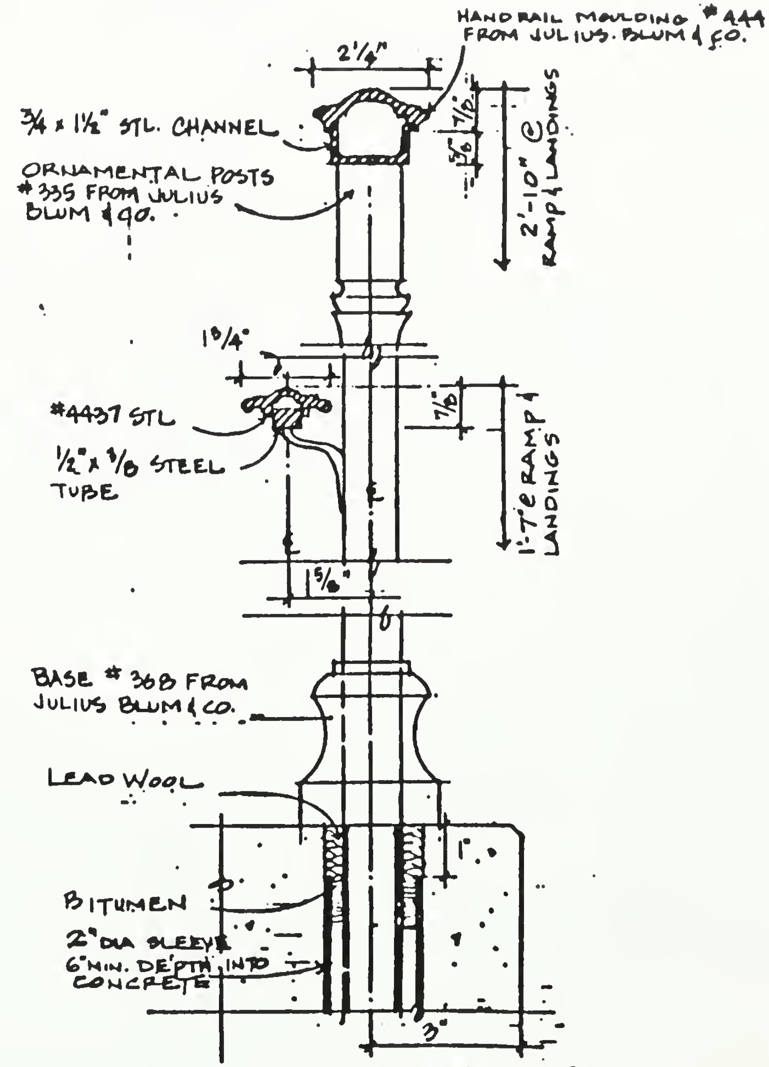
Perform mortar analysis on old mortar to determine mix ratio and sand color.

Surface clean entire masonry portion of building.

Scrape, sand and paint all exterior trim, siding, doors and windows.

Re-putty all windows

Repoint most of entire bldg.



CAST IRON HANDRAIL DETAILS
3" = 1'-0"

CHESTER JAIL

Chester Railroad Depot

The Pioneer Valley Planning Commission contracted with the architectural firm of Margo Jones to develop outline specifications and operating cost estimates for the rehabilitation and renovation of the Chester Railroad Depot (Depot, hereafter). The Chester Depot is an historically significant structure which is part of the transportation history of the Route 20 corridor. It is the intention to make specific improvements to this structure to allow for its use as a visitor's center for the Jacob's Ladder Trail. Improvements would include site work, platform construction, exterior capboard replacement, bathroom renovations and the provision of interpretive signage and displays. The location of Chester Depot is shown on page 62.

Assessment of Depot

The Chester Depot, the oldest depot in Massachusetts, dated 1841, is currently under the custodialship of the Chester Foundation, a private not for profit organization, dedicated to the preservation and enhancement of Chester's economy, history and beauty. The foundation acquired the structure in 1990 from Conrail and moved it across the railroad tracks to its present location. This effort resulted in a new foundation, structural repairs and the provision of a water tight exterior. However, considerable work must be undertaken to allow the structure to be used as a visitor's and multi-use facility.

The depot building was built 154 years ago and was the center of a booming economy for a century. The station had a restaurant for passengers and workers and enabled local farmers and manufacturers to reach distant markets for their goods and produce. It was also a part of a transportation complex in Chester which included a coaling tower, water station for the steam engines and a round house for pusher engines to help the regular engines pull cars up the steep incline to the plains, leading to Albany, New York. Across the street from the station are the remains of the Chester Granite Company and the terminal point for the Chester and Becket Railroad.

In general, a great deal of site work and landscaping is needed to make the site amenable. The entire site requires regrading and will also result in a paved access road and parking area, drainage, a relocated right-of-way, plantings, a new flagpole, signage and exterior lighting. The lighting should reflect the railroad character of the building such as a shepherd's crook pole with down lighting style light fixtures.

The structure will require new six foot wide platforms or decks on both elongated sides of the structure. Railings will be required as specified by building and accessibility code. Other improvements include interior storm windows, exterior screens, refinishing of all interior wood flooring and signage.

The estimated total cost of the rehabilitation is approximately $196,400. The estimated yearly operating and maintenance costs for the building as rehabilitated is approximately $6,600.

Outline of Work and Preliminary Budget Cost Estimate

General Conditions: $ 13,600

Site Work: $ 45,000

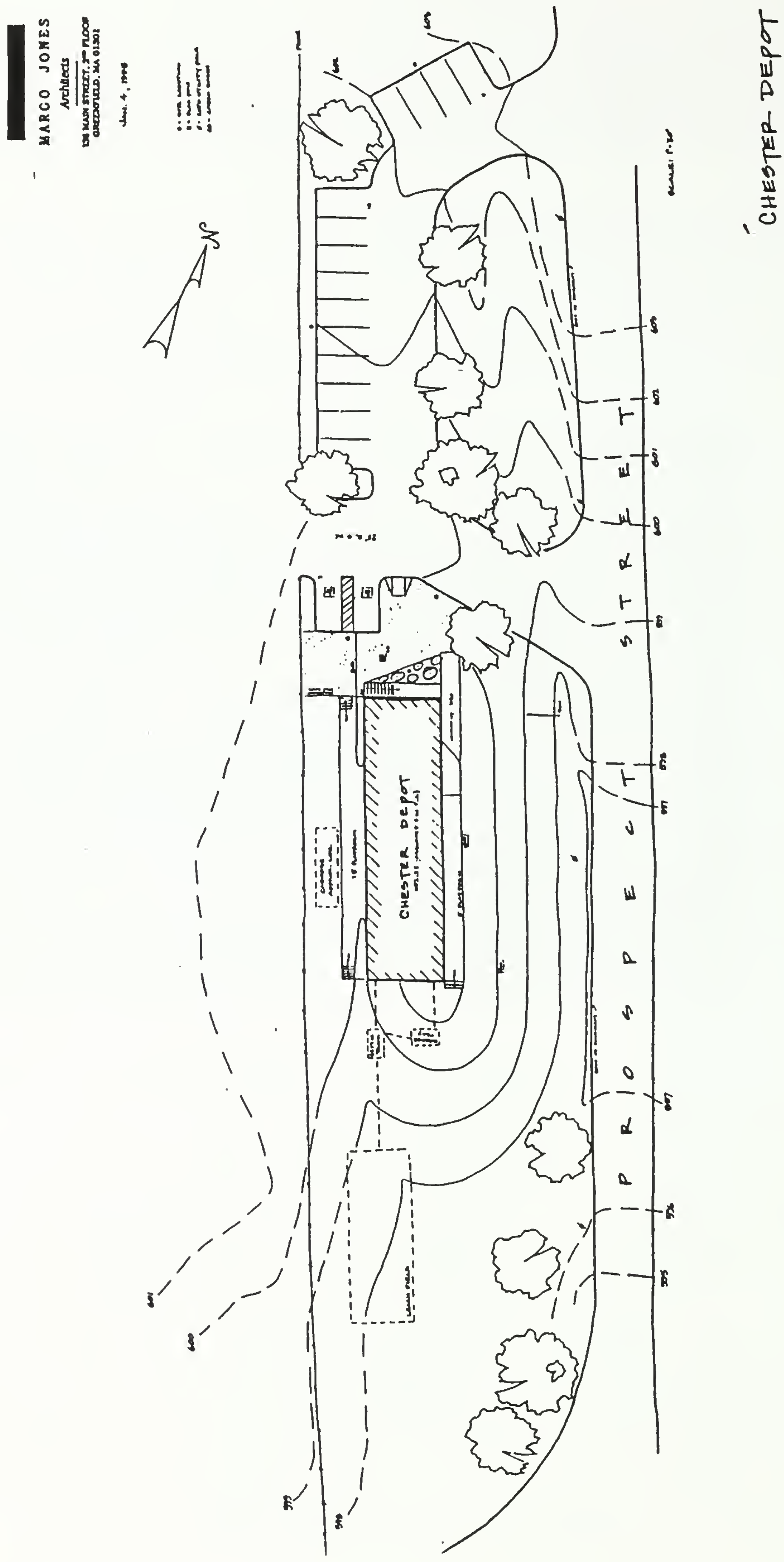
- Regrade site to accommodate parking and other improvements as noted on accompanying site plan.
- Pave new parking area; provide sixteen spaces, including two handicapped.
- Concrete curbing at perimeter of all new paving.
- Leaching basin in plaza area at north side of building.
- Bike rack at plaza.
- Underground conduit for site lighting.
- Landscaping as noted on accompanying site plan. Various deciduous and shrubs to be provided throughout the site. Balance of site to be seeded.

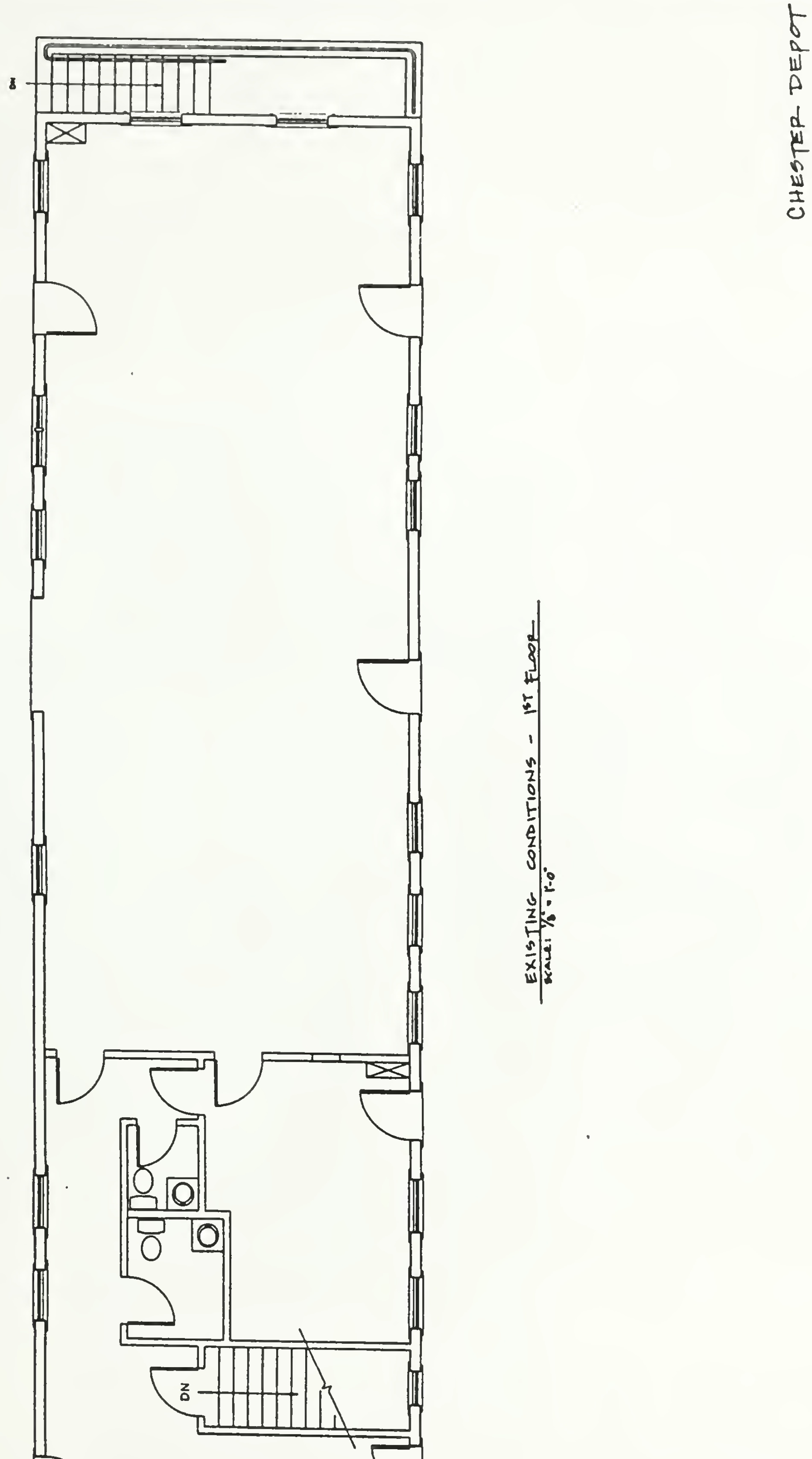
Painting: • Paint or seal all new wood. • Touch-up interior and exterior as required by improvements. • Strip and refinish all wood flooring throughout interior of depot.	$ 9,300
Electrical: • Provide and install new exterior lighting (site and building)	$ 5,500
Interpretive Displays and Signage: • Provide for exterior interpretive signage, interior signage and interior interpretive display cases.	$15,000
Overhead & Profit:	$10,000
Bonds:	$ 2,000
Architectural Design & Oversight:	$24,000
Contingency:	$26,500
TOTAL	**$196,400**

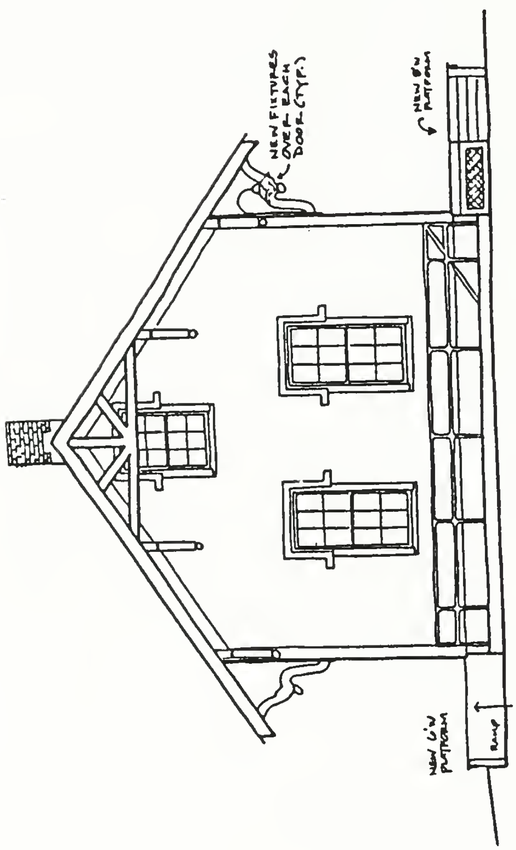
Opinion of Probable Costs for Yearly Operating and Maintenance

The following estimates are based on use as a visitor's center from May - October, open daily with it's use limited to only one day per month the balance of the year.

Heating:	$1,150
Electric:	$ 650
Water:	$ 300
General Maintenance: • Interior/exterior, based on 4,013 s.f. floor area	$2,500
Reserve Fund: • 1% of budget estimate	$2,000
TOTAL	**$6,600**

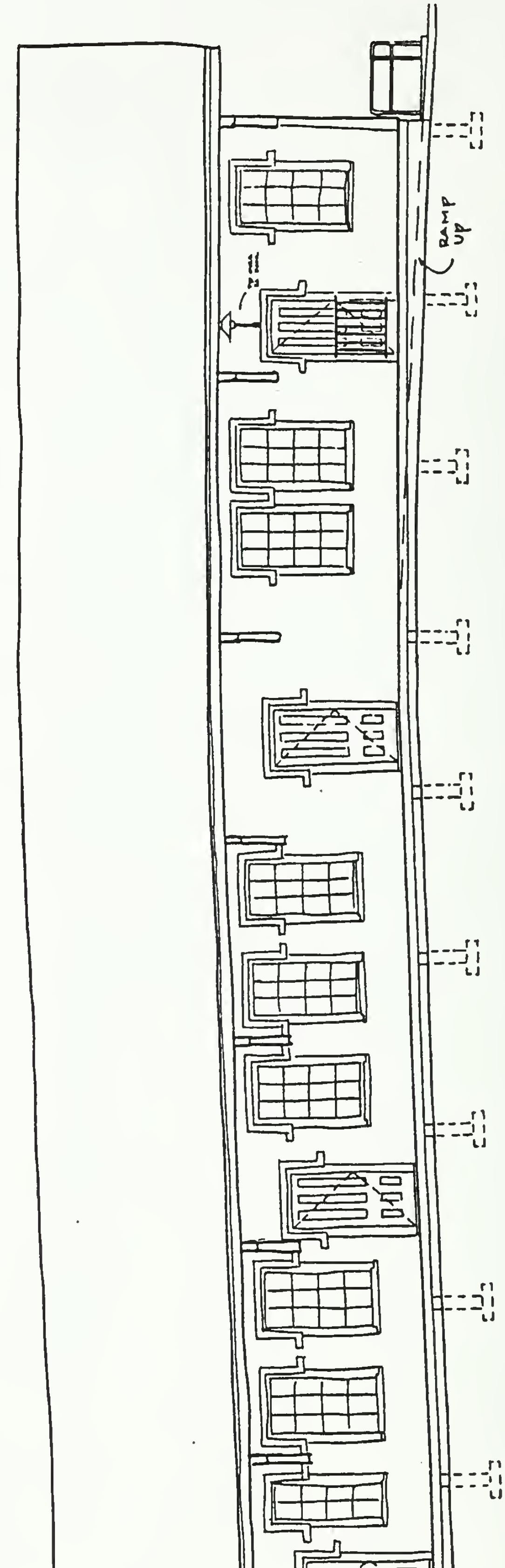

MARGO JONES
Architects
136 MAIN STREET, 3rd FLOOR
GREENFIELD, MA 01301
CHESTER DEPOT
PROSPECT STREET
CHESTER DEPOT


CHESTER DEPOT
EXISTING CONDITIONS - 1ST FLOOR
SCALE: 1/8" = 1'-0"
DN



NORTH ELEVATION

SCALE: 1/8" = 1'-0"

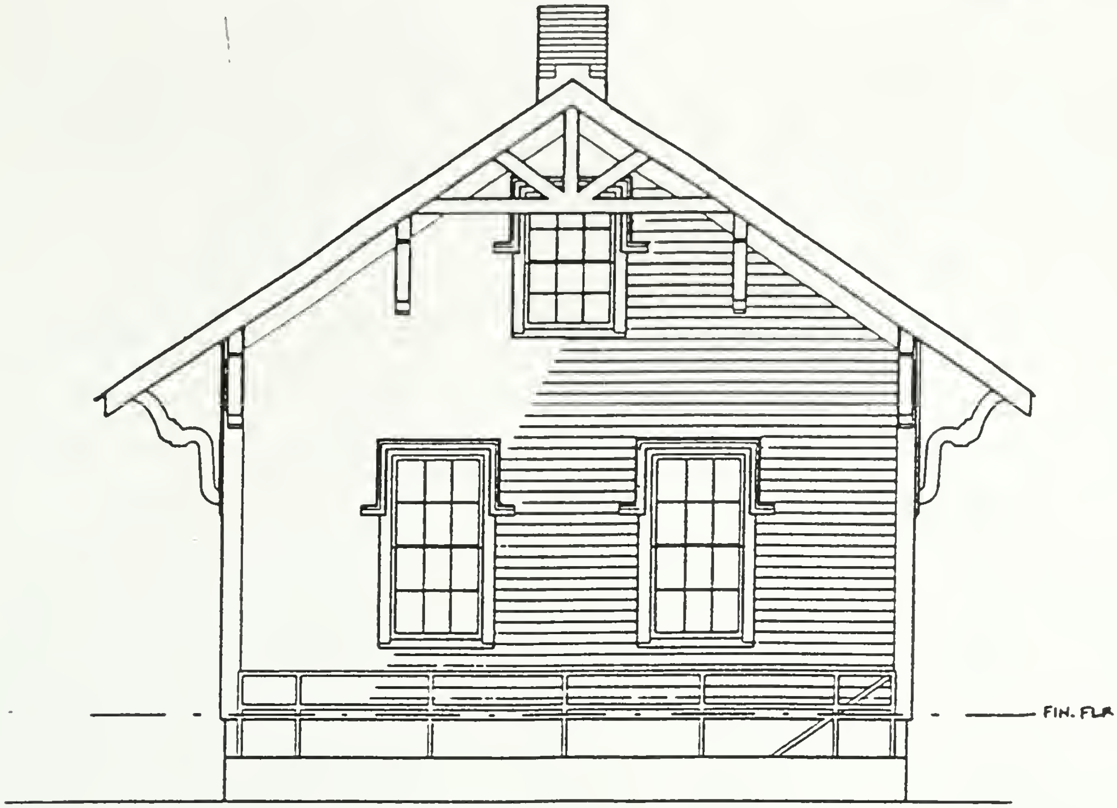


EAST ELEVATION

SCALE: 1/8" = 1'-0"

CHESTER DEPOT

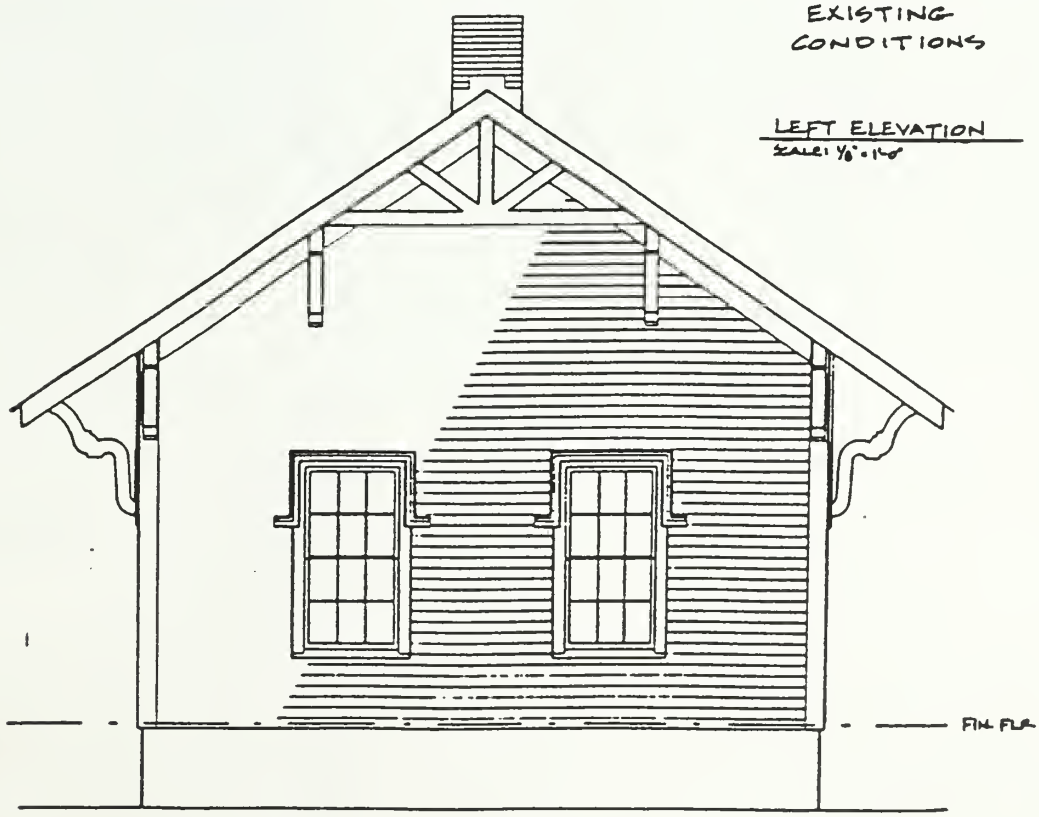
CHESTER DEPOT

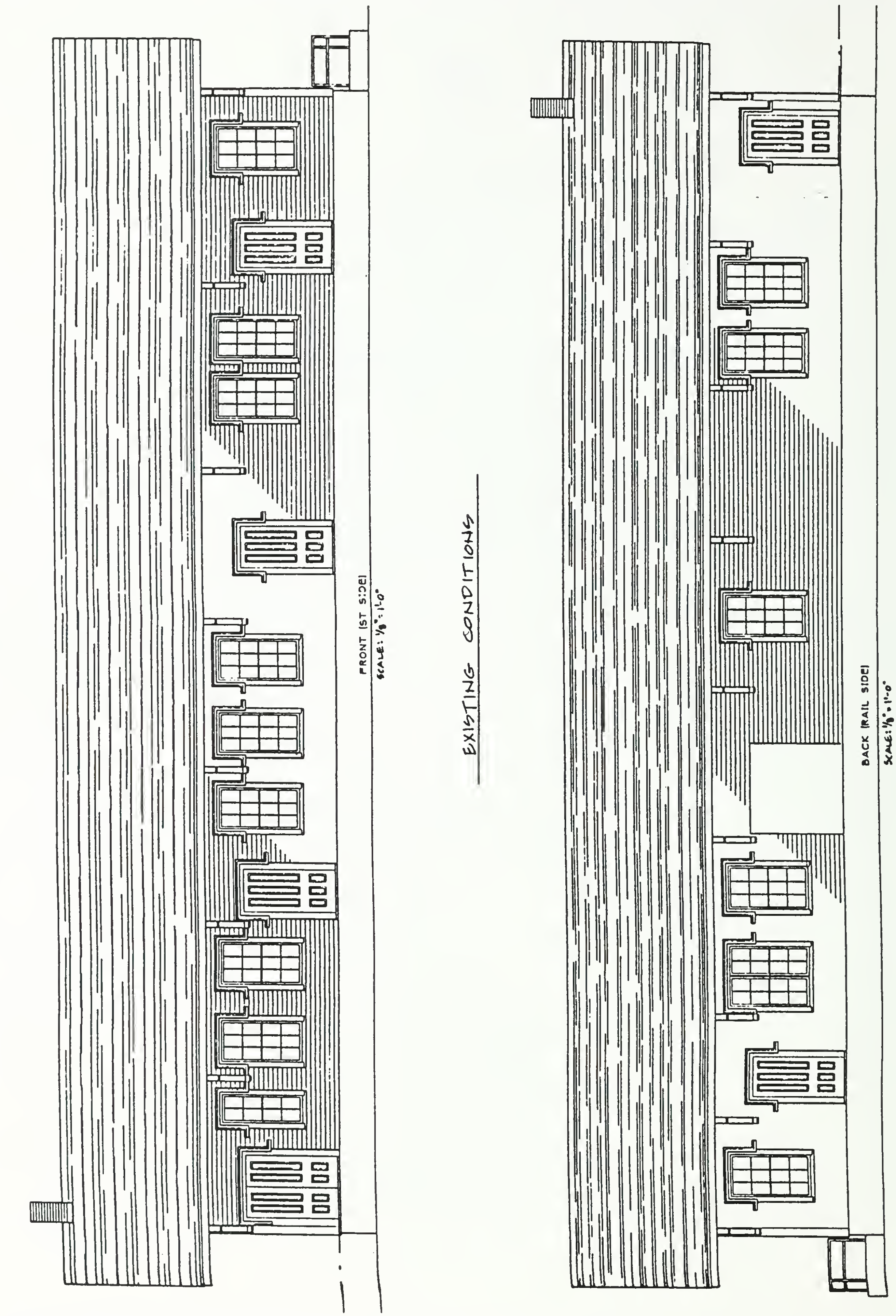


RIGHT ELEVATION
SCALE: 1/8" = 1'-0"

EXISTING CONDITIONS

LEFT ELEVATION
SCALE: 1/8" = 1'-0"




FRONT (ST SIDE)
SCALE: 1/8" = 1'-0"
EXISTING CONDITIONS
BACK (RAIL SIDE)
SCALE: 1/8" = 1'-0"

Scenic Turn -Outs

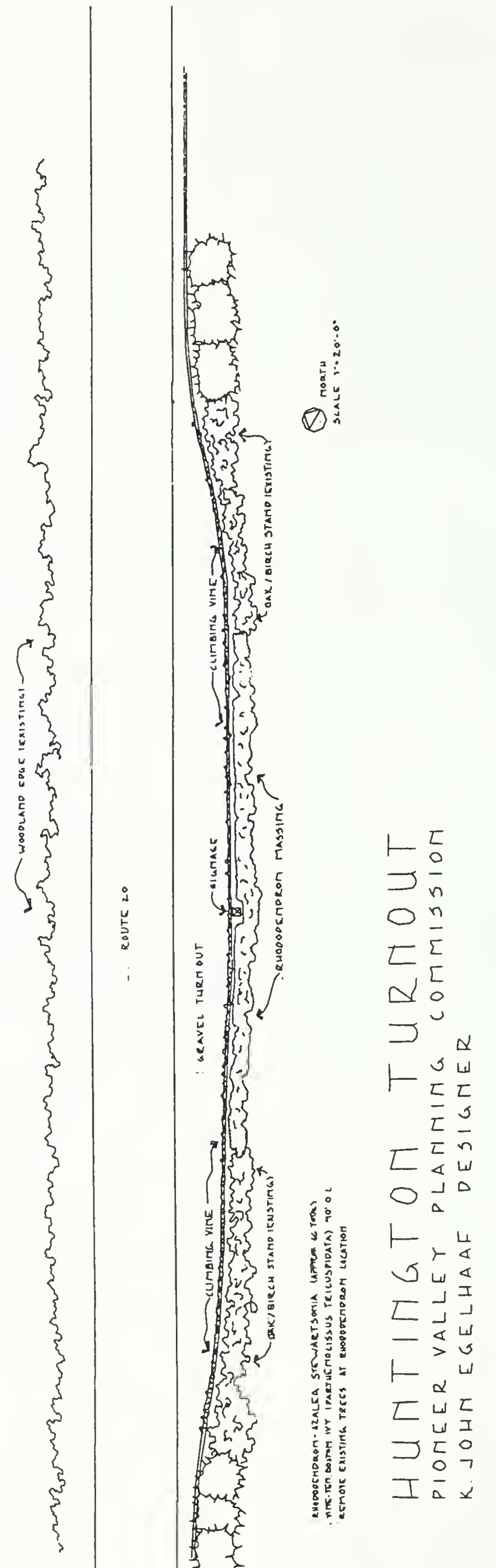
The Phase I Management Plan identified a number of areas of aesthetic, cultural and historical significance including specific locations or stretches of highway along the scenic byway. Five pre-existing turn-out areas were identified, one in each of the five Jacob's Ladder Trail communities. The intention was to provide a series of turn-outs consisting of native shrubbery and flowers and low impact interpretive signage so as to educate and inform those traveling along the Jacob's Ladder Trail.

This project provides landscape architectural designs for each of the sites, including recommended plantings, surface treatments and thinning practices. The design plans are based on an assumed operating budget of $25,000 for all five turn-outs or approximately $5,000 per turn-out. The specific location of each turn-out is noted below. These are also shown on the improvements plan base map found at the beginning of this report. The specific landscape designs follow over the next few pages. The locations of the turnouts are shown below.

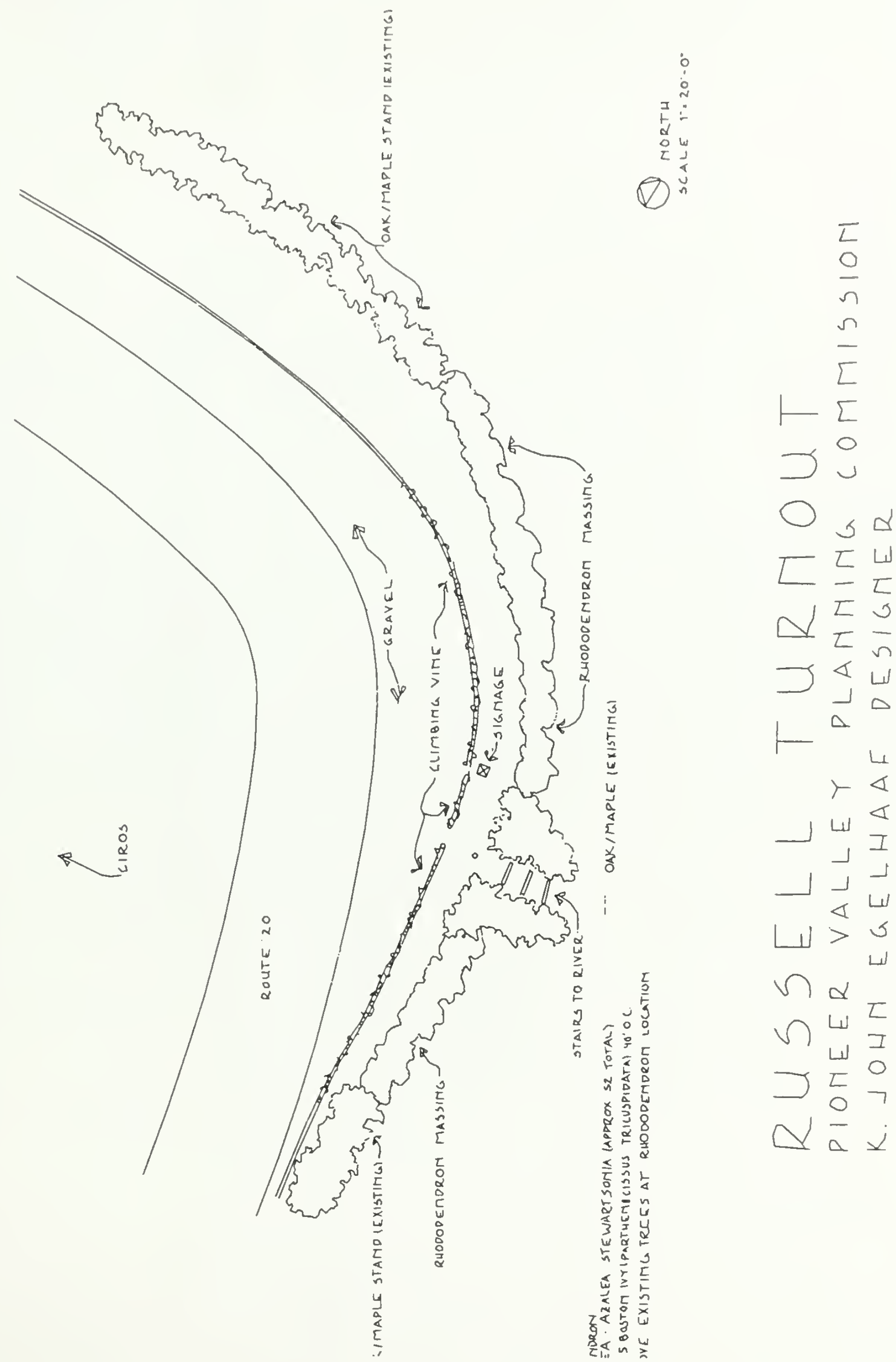
Table 8. Turn-Out Mile Marker Locations.

Municipality	Mile Marker Location
Russell	44.4
Huntington	41.3
Chester	36.7
Becket	29.3 - 29.2
Lee	23.1

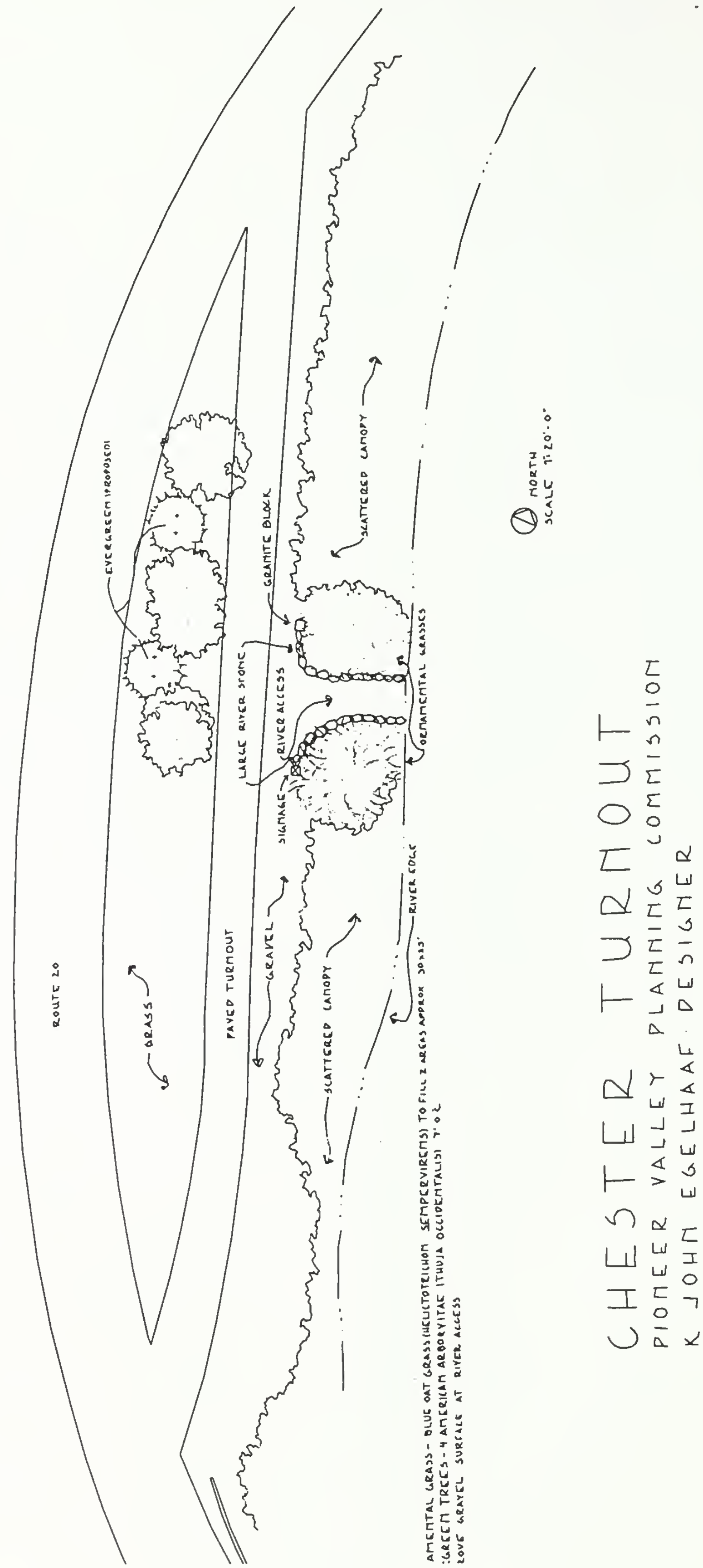
The selection of these areas was based on a variety of factors including location, scenic or aesthetic value, historical value and condition. Two turn-outs (Russell and Chester), are located along the Westfield River, two (Huntington and Lee) provide scenic vistas and one (Becket) provides a direct link to the past. This latter turn-out in Becket is especially interesting because it allows the visitor to understand the origination of the Jacob's Ladder Trail. Jacob's spring and well is located at this site. It was used in the early 1900s to provide water to over-heated automobiles trying to climb the highway, later known as the "ladder."



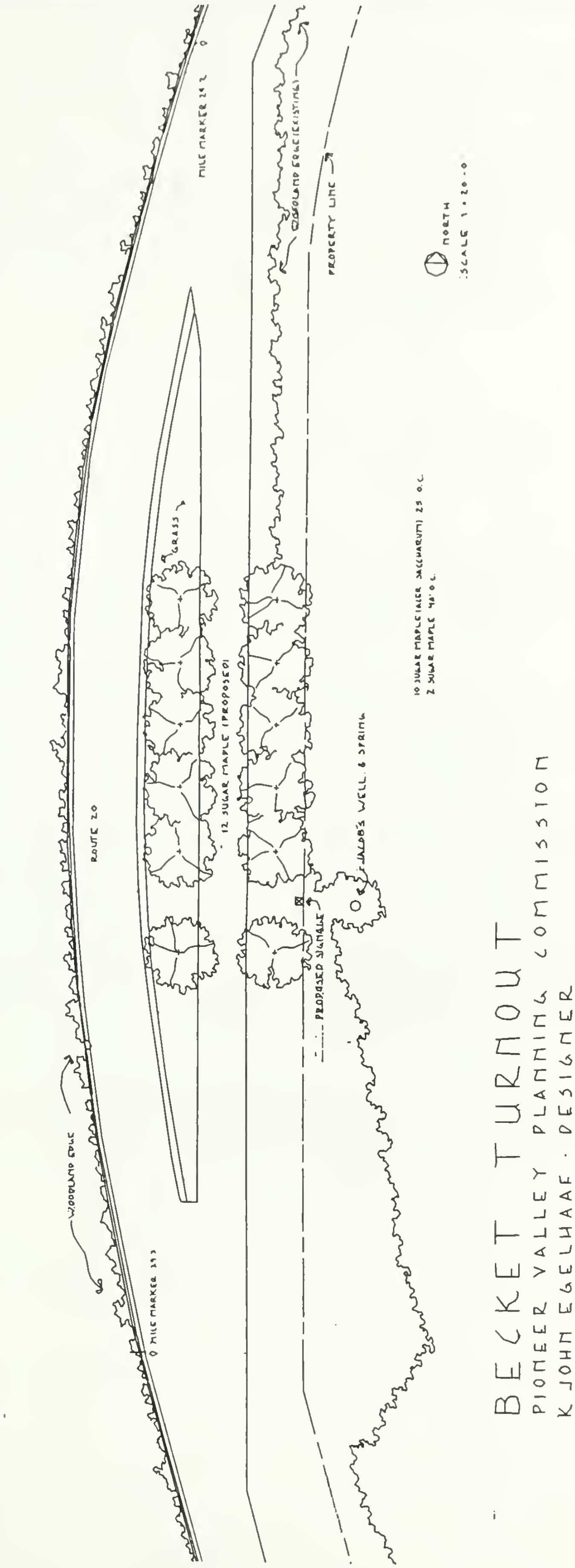
Huntington Turnout



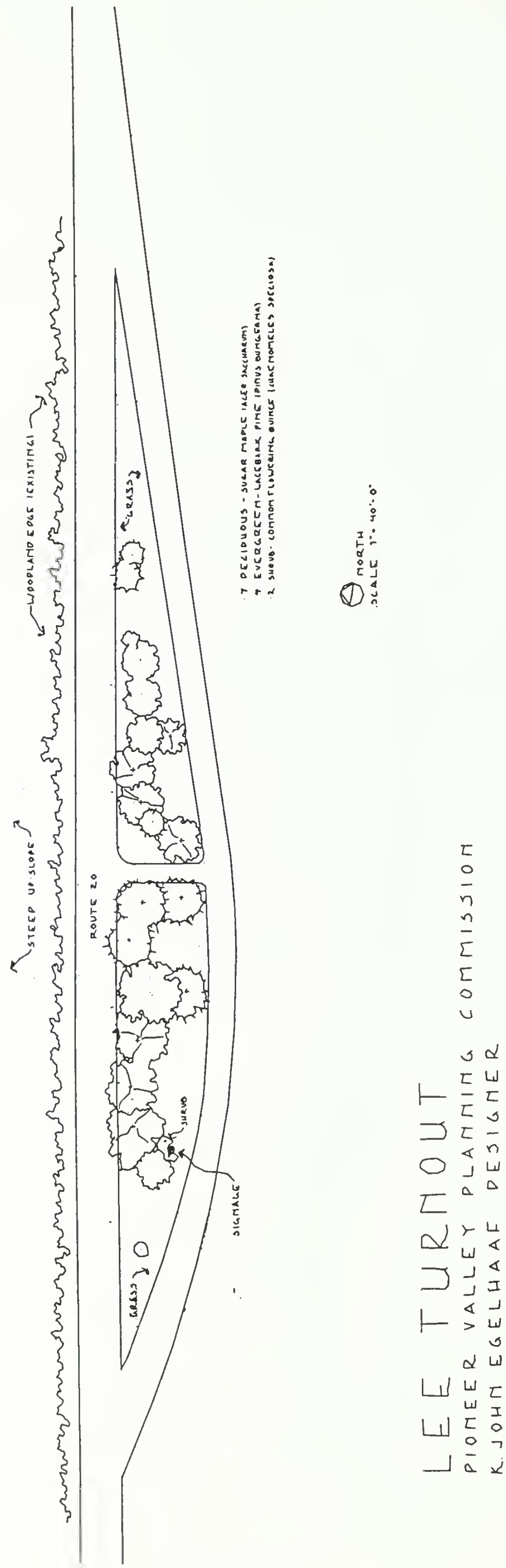
Russell Turnout



Chester Turnout



Becket Turnout


LEE TURNOUT
PIONEER VALLEY PLANNING COMMISSION
K. JOHN EGELHAAF DESIGNER
ROUTE 20
STEEP UP SLOPE
WOODLAND EDGE (EXISTING)
GRASS
SIGNAGE
SHRUB
NORTH
SCALE 1" = 40'-0"

Lee Turnout

Appendix A

Level of Service

Level of Service is an indicator of the operating conditions which occur on a given roadway under various traffic volumes. It is a qualitative measure based on a number of operational factors including roadway geometrics, speed, travel delay, freedom to maneuver, and safety. After the assessment of these criteria, a Level of Service can be assigned to a roadway or intersection. This is equivalent to presenting an "index" to the operational qualities of the section under study. Level of Service is defined in the 1985 Highway Capacity Manual[1] by six levels, "A" to "F."

Depending on the time of day, day of week, or period of year, any given roadway can operate at a wide range of Level of Service. On a two-lane highway, the Level of Service is based upon the accessibility and mobility of a given section. The following presents a description of the criteria for each Level of Service rating in more detail:

Level of Service "A" represents the best operating conditions and indicates optimum, free-flowing traffic. Under these conditions, drivers are able to travel at their desired speed with little or no passing required. In addition, there are very few observed "platoons" of traffic of three vehicles or more.

Level of Service "B" indicates a greater flow of traffic than under level of Service "A" conditions. The number of "platoons" in the traffic stream begin to increase, and drivers are often required to initiate passing maneuvers in order to maintain their desired travel speed.

Level of Service "C" indicates a condition of stable flow with noticeable increases in passing limitations and "platoon" size. Small pockets of congestion begin to arise due to turning movements and slower moving vehicles.

Level of Service "D" conditions and delays are considerably longer than under LOS "C" conditions with average "platoon" sizes of 5 to 10 vehicles. The average travel speed is in the vicinity of posted limits, however, passing maneuvers are increasingly difficult due to the higher volume of traffic in both directions.

Level of Service "E" results in the roadway beginning to operate at unstable flow conditions as the facility is operating at or near its capacity. The average travel speed is reduced, especially on significant uphill grades, and sizable "platoons" begin to form in response to slower moving vehicles and interruptions to the traffic stream.

Level of Service "F" or failure, generally indicates forced flow conditions illustrated by long delays and vehicles queues. Passing is difficult, if not impossible, and vehicles attempting to enter the traffic stream from side streets suffer very long delays.

Deciding which criteria to use is based on the amount of delay and congestion a community is willing to tolerate versus the amount of money it is willing to spend on improvements to their roadway network.

[1] Transportation Research Board, Special Report 209, Highway Capacity Manual, Washington, D.C., 1985.

Appendix B

Location of "Unsafe" Bicycle Catch Basin Grates on the Jacobs Ladder Trail

Dir.	Grate #	Town	Miles from Start of JLT	Miles from Last Grate	Miles from Town Line	Description
SB	1	Becket	8.2	0	3.2	by Jacobs Pillow sign, before mile marker 27
SB	2	Becket	9	0.8	4	
SB	3	Becket	9.7	0.7	4.7	by telephone pole, before right arrow sign
SB	4	Becket	9.7	0	4.7	
SB	5	Becket	10.95	1.25	5.95	
SB	6	Becket	10.95	0	5.95	
SB	7	Becket	10.95	0	5.95	
SB	8	Becket	10.95	0	5.95	
SB	9	Becket	11.35	0.4	6.35	at Sir Galahad Dr.
SB	10	Becket	11.5	0.15	6.5	two grates
SB	11	Becket	11.5	0	6.5	
SB	12	Becket	11.5	0	6.5	
SB	13	Becket	11.5	0	6.5	
SB	14	Becket	11.5	0	6.5	
SB	15	Becket	11.5	0	6.5	
SB	16	Becket	11.5	0	6.5	
SB	17	Becket	11.5	0	6.5	
SB	18	Becket	11.5	0	6.5	
SB	19	Becket	11.5	0	6.5	
SB	20	Becket	11.5	0	6.5	
SB	21	Becket	11.5	0	6.5	
SB	22	Becket	11.5	0	6.5	before Route 20 and 8 sign
SB	23	Becket	13.2	1.7	8.2	
SB	24	Becket	13.2	0	8.2	
SB	25	Chester	17.2	4	1.8	
SB	26	Huntington	23.25	6.05	1.25	
SB	27	Huntington	23.25	0	1.25	before right arrow sign
SB	28	Huntington	23.25	0	1.25	at Aldrich St.
SB	29	Huntington	23.25	0	1.25	
SB	30	Huntington	23.95	0.7	1.95	just before Gateway Auto and Farm Supply sign
SB	31	Russell	25.05	1.1	0.5	
SB	32	Russell	25.85	0.8	1.3	
SB	33	Russell	25.85	0	1.3	just after mile marker 44
SB	34	Russell	26.4	0.55	1.85	just after Ciro's restauraunt
SB	35	Russell	26.4	0	1.85	
SB	36	Russell	26.4	0	1.85	
SB	37	Russell	27.1	0.7	2.55	just before house # 225
SB	38	Russell	27.1	0	2.55	at Rocky Brook St.
SB	39	Russell	27.1	0	2.55	
SB	40	Russell	27.1	0	2.55	
SB	41	Russell	27.1	0	2.55	

Location of "Unsafe" Bicycle Catch Basin Grates on the Jacobs Ladder Trail

Dir.	Grate #	Town	Miles from Start of JLT	Miles from Last Grate	Miles from Town Line	Description
NB	1	Russell	1.65	0	1.65	at end of guardrail, before driveway
NB	2	Russell	2.5	0.85	2.5	about 50 ft. before right arrow sign
NB	3	Russell	2.5	0	2.5	
NB	4	Russell	3.9	1.4	3.9	
NB	5	Russell	4.25	0.35	4.25	2 grates
NB	6	Russell	4.25	0	4.25	
NB	7	Russell	4.7	0.45	4.7	
NB	8	Russell	4.7	0	4.7	at Mt. Laurel Dr.
NB	9	Russell	4.7	0	4.7	
NB	10	Russell	4.7	0	4.7	
NB	11	Huntington	7.35	2.65	0.8	just before "Adopt a Highway" sign
NB	12	Chester	11.7	4.35	5.4	at mile marker 37.702, Bannish Lumber Driveway
NB	13	Chester	13.3	1.6	7	
NB	14	Chester	13.8	0.5	7.5	in front of Chester Fire Dept.
NB	15	Chester	15.25	1.45	8.95	before falling rock sign
NB	16	Becket	18.4	3.15	2.8	around corner after intersection, before right arrow sign
NB	17	Becket	18.9	0.5	5.95	just before right arrow sign in front of mailbox
NB	18	Becket	19.4	0.5	6.45	just after fire truck sign
NB	19	Becket	19.4	0	6.95	
NB	20	Becket	20.1	0.7	6.95	one on each end of horseshoe turnoff and one just past it
NB	21	Becket	20.1	0	7.65	
NB	22	Becket	20.6	0.5	7.65	just past "West 20" and "South 8" signs
NB	23	Becket	20.6	0	8.15	
NB	24	Becket	20.6	0	8.15	
NB	25	Becket	20.6	0	8.15	
NB	26	Becket	21	0.4	8.15	two grates a few feet apart across from Sherwood Greens
NB	27	Becket	21	0	8.55	
NB	28	Becket	21	0	8.55	at Beckett Woods sign
NB	29	Becket	21.4	0.4	8.55	two grates about 100 feet apart
NB	30	Becket	21.4	0	8.95	
NB	31	Becket	21.9	0.5	8.95	before right arrow sign
NB	32	Becket	21.9	0	9.45	across from Mystic Isle sign
NB	33	Becket	22.3	0.4	9.45	in front of Jacobs Pillow sign
NB	34	Becket	22.3	0	9.85	just past "West 20" and "South 8" signs
NB	35	Becket	22.3	0	9.85	
NB	36	Becket	22.3	0	9.85	
NB	37	Becket	22.3	0	9.85	
NB	38	Becket	22.7	0.4	9.85	
NB	39	Becket	22.7	0	10.25	
NB	40	Becket	22.8	0.1	10.25	just before mile marker 26.16
NB	41	Lee	30.5	7.7	4.3	right before the Pilgrim Motel

JACOB'S LADDER TRAIL

PIONEER VALLEY
PLANNING COMMISSION
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